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THE

TREATMENT OF DISEASE

A MANUAL OF

PRACTICAL MEDICINE

BY

REYNOLD WEBB WILCOX, M.A., M.D., LL.D.

PROFESSOR OF MEDICINE AT THE NEW YORK POST GRADUATE MEDICAL SCHOOL AND HOSPITAL; CONSULTING PHYSICIAN TO THE NASSAU HOSPITAL; VISITING PHYSICIAN TO ST. MARK'S HOSPITAL; FELLOW OF THE AMERICAN ACADEMY OF MEDICINE MEMBER OF THE AMERICAN THERAPEUTIC SOCIETY AND OF THE AMERICAN MEDICAL ASSOCIATION; PERMANENT MEMBER OF THE MEDICAL SOCIETY OF THE STATE OF NEW YORK; HONORARY MEMBER OF THE CONNECTICUT STATE MEDICAL SOCIETY; VICE-CHAIRMAN OF THE REVISION COMMITTEE OF THE UNITED STATES PHARMACOPŒIA, ETC.

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TO

THE MEMORY OF

MY GRANDFATHER,

REYNOLD WEBB, M. D.,

AND MY UNCLE,

DANIEL MEIGS WEBB, A. M., M. D.,

THIS VOLUME IS DEDICATED.

PREFACE TO SECOND EDITION.

THE short time which has elapsed since the appearance of the first edition of this work has not been marked by any important advances in medicine which necessitate radical changes in this treatise. The opportunity offered has been employed to thoroughly revise the literary style, correct unavoidable errors, make more specific statements in regard to treatment and to add new matter upon mountain and tick fevers, blastomycotic infections, methyl alcohol intoxication, indicanuria, compressed air disease and the trembles.

PREFACE TO FIRST EDITION.

TWENTY-THREE years' experience in teaching more than ten thousand medical graduates has impressed upon the author that the practitioner desires especially the latest views upon questions of diagnosis and methods of treatment. Under the influence of Post Graduate Schools the medical student is more thoroughly grounded in diagnosis, and particularly in physical diagnosis, than formerly. There still remains an anxious endeavor on the part of the physician to increase his knowledge of therapeutics, whether physical, medicinal or dietetic, which goes to make up what may be termed the management of a patient suffering from disease. While ætiology is important, pathology is interesting and a sound basis, and diagnosis is essential, it is from a thorough and broad knowledge of therapeutics in its larger sense that the practitioner will achieve his greatest success and win his most enduring reputation among his patients and the public at large. The therapeutic awakening which is now being experienced, shows that more to-day, than ever before, is expected of the clinician. With the practical needs of the physician always in view, this book has been written. To Dr. Henry Hubbard Pelton, Instructor in Medicine at the New York Post Graduate Medical School and Hospital, and Chief of Medical Clinic, Presbyterian Hospital Dispensary, who has diligently collected his lectures during the sessions of 1904–7, who has filled the *lacunæ* inseparable to clinical teaching and who has borne the labor of proof-reading and index-making, the author would tender his heart-felt acknowledgment of his varied and valuable services.

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INTRODUCTION.

In a treatise upon Practical Medicine the classification of the various diseases is to be undertaken with circumspection, for the progress which is daily taking place in the study of pathologic states is continually rendering it necessary for us to change our opinions of the nature of morbid conditions. Theories which have been credited as facts are frequently being controverted or are becoming hypotheses while apparently established facts may be overthrown to give place to their successors. As an instance, pneumonia and acute articular rheumatism are now regarded as infections while previously the former was classed with diseases of the lungs and the latter with morbid conditions of the joints. It is not at all improbable that soon we shall be considering certain affections, now classed as splenic, as diseases of the blood and *vice versa*, and other changes in classification are quite as possible. Hence the difficulty of arranging a given list of diseases in a manner which shall not be subject to criticism.

On the other hand it matters little under what heading a disease is considered, for the various organs and bodily systems are so intimately related that an affection of one of these can hardly exist as a distinct entity. In almost every instance associated morbid processes are taking place in other structures which have a definite bearing upon the primary state.

For this reason the present-day tendency toward specialism in internal medicine is to be decried and a reversion to the type of physician commonly designated as the "General Practitioner" advocated. It is such a medical man who, when confronted by a difficult problem, will grasp the moment when the aid of the surgeon or that of another worker in special fields is necessary; and this consultant will take in hand the work properly begun by the practitioner and carry it to a successful conclusion which shall be quite as much a result of the skill of the one as that of the other.

The tendency of the specialist is to attribute all the symptoms of which he complains to some lesion of the organ or system in which he is interested, forgetting, perhaps, that other organs exist; thus the gastrologist loses sight of the possibility that the stomach symptoms of a patient, to ascertain the reasons for which the resources of chemistry are exhausted, may be an evidence of a beginning tuberculous process at a pulmonary apex and are not due to some disorder of the gastric motility or to a secretory abnormality of the glands of the stomach. Likewise the specialist upon thoracic diseases must not neglect nor be unable to treat intelligently the renal condition associated with a given instance of pulmonary emphysema or aortic obstruction, and the clinician who devotes himself exclusively to the subject of acute diseases should recollect the extreme probability of the occurrence of cardiac involvement when treating a patient afflicted with acute polyarthritis. Numerous instances

might be cited showing the intimate relation of the diseases of one system to those of others but these will suffice.

In eliciting a patient's history the importance of the consideration of heredity lies less in the possibility of the direct transmission of disease than in that of the inheritance of a constitution predisposed to morbid affections by reason of its inherited vitiated powers of resistance. Not only may such a diminished resistance to disease be handed down from father to child but there is a definite possibility that the offspring of physically strong forbears may possess an increased resistance to disease which may account for some of the instances of apparent natural immunity which are observed.

In considering the ailments from which an individual has previously suffered we must not lose sight of the fact that these may have a material bearing upon the disease which now brings him to the physician, in obtaining the history of which we must revert to the first noticed symptom, and its character. The associated manifestations must then be ascertained until we are able to learn which organ is chiefly affected and the others which are probably involved in consequence.

Having elicited the patient's history, we should proceed to the physical examination, and this being accomplished we are finally ready to make the diagnosis.

Here it is a well-recognized fact that, in every instance, we must proceed by a process of exclusion, all the possibilities being ruled out one by one until we have sifted the matter to its bottom and the true diagnosis is established.

After diagnosis, treatment is to be considered and, while not underrating the value of pathological knowledge nor decrying the importance of ætiology or history and without ignoring the advantage of expert physical diagnosis, or minimizing the weight of trained and logical reasoning or deprecating the assumption of conclusions based on long-continued experience—all of which are necessary for a correct diagnosis—we must insist that learning and experience are in greatest demand in deciding upon the treatment to be prescribed. This is, to the mind of the patient, the most important consideration, for to him history and diagnosis are merely subsidiaries, his object in consulting the physician being less to learn the character of his ailment than to obtain relief.

In formulating a method of treatment for a given affection the various therapeutic measures at our disposal must be considered separately, and, more than all, in prescribing for our patient we must not use the diagnosis as a figurative peg upon which to hang a varied series of methods of treatment selected haphazard, but we should, remembering the while that most important and very definite entity the personal equation, treat the patient and not his disease.

With a view toward systematizing and correlating our knowledge careful records of all patients should be kept and the following method of recording histories, physical examinations and other data is suggested.

CASE RECORD:

Record data below:

NAME—AGE—OCCUPATION—SOCIAL CONDITION—BIRTH-PLACE—PLACE OF RESIDENCE—DATE OF EXAMINATION.

HISTORY.—Hereditary Tendencies—Notable Habits—General Surroundings—Previous Illness and Accidents—Causes, Manner of Attack, Duration and Course of Present Illness.

SYMPTOMS:

Alimentary System. — Deglutition — Appetite — Sensations during Fasting and after Eating (*Discomfort — Pain — Weight — Distention — Heartburn — Nausea*) — Acidity — Flatulence—Eructation—Pyrosis—Vomiting. State of Bowels (*Frequency—Color of Stools—Tenesmus.*)

Circulatory System.—Subjective Phenomena (*Pain—Palpitation—Faintness—Dyspnœa*).

Respiratory System.—Breathing (*Painfulness*)—Cough—Larynx (*Pain*).

Integumentary System.—Subjective Phenomena—Skin (*Dryness—Itching—Moisture*).

Urinary System.—Subjective Phenomena (*Pain in Loins, Bladder or Urethra*)—Micturition (*Frequency*).

Reproductive System.—MALE—Abnormal Discharges—Functions — Subjective Phenomena. FEMALE—Catamenia—Pregnancies—Abnormal Discharges—Subjective Phenomena.

Nervous System.

Sensory Functions.—Sensations (*Pain—Heat—Cold—Formication—Numbness—Tingling—Girdle Pain—Vertigo*).

Motor Functions. — Organic Reflex (*Swallowing — Breathing—Micturition—Defœcation*).

Vasomotor and Trophic Functions.—Subjective Phenomena.

Cerebral and Mental Functions.—Subjective Phenomena—Sleep.

Locomotory System.—Subjective Phenomena.

SIGNS:	*Record data below:*
Status Præsens. **General Facts.**—Height—Weight—General Appearance (*Temperament—Attitude and Expression*)—Temperature.	
Alimentary System.—Lips—Teeth—Gums—Tongue—Fauces—(*Characters, Macroscopic and Microscopic, of Vomited Matters*)—Character of Fæces—(*Macroscopic and Microscopic Examinations*)—Abdomen (*Prominence—Retraction—Distention—Flaccidity—Tenderness—Fluctuation—Outline of Normal or Abnormal Contents*)—*Röntgen-ray Examination.*	
Hæmopoietic System.—Lymphatic Vessels and Glands—Ductless Glands (*Spleen—Thyroid*)—Microscopical Characters of Blood—Hæmoglobin Percentage—Specific Gravity—Coagulation Time—Cryoscopic Examination.	
Circulatory System.—Inspection (*Form and Appearance of Precordium*)—Palpation (*Position and Character of Cardiac Impulse*)—Percussion (*Superficial and Deep Outline*)—Auscultation (*Rhythm and Quality of Sounds in Mitral, Tricuspid, Aortic and Pulmonary Areas, over General Surface of Heart and Main Vessels*)—Pulse (*Frequency—Rhythm—Character—Sphygmographic Tracings*)—Arteries, Veins and Capillaries—*Röntgen-ray Examination—Blood Pressure Estimation.*	
Respiratory System.—Breathing (*Frequency—Rhythm—Type*)—Sputa (*Macroscopic and Microscopic Characters*)—Nares (*Rhinoscopic Examination*)—Pharynx—Larynx—(*Voice—Tenderness—Laryngoscopic Examination*)—Inspection (*Form and Action of Thorax*)—Mensuration (*Spirometric Tests*)—Palpation (*Vocal Fremitus*)—Percussion (*Anterior and Posterior, on both sides*)—Auscultation (*Determination, during Natural and Deep Respiration, of the Duration of the Sounds, their Character, Accompaniments, and of the Vocal Resonance—Tussive Signs*)—*Röntgen-ray Examination.*	

SIGNS (Continued):

Record data below:

Integumentary System.—Obesity—Emaciation—Œdema—Emphysema—Eruptions (*Distribution—Elements of Skin Involved—Type—Cause*).

Urinary System.—Urine—Quantity—Color—Specific Gravity—Chemical Reactions (*Acidity—Alkalinity—Albumin—Sugar—Bile—Indican—Amount of Urea and Uric Acid*)—Sediment (*Macroscopic and Microscopic Characters*)—Cryoscopic Examination—*Röntgen-ray Examination.*

Reproductive System.—MALE—Testicle—Epididymis—Prostate—Urethra (*Endoscopic Examination*)—Bladder (*Cystoscopic Examination and Result of Ureteral Catheterization*)—Abnormal Discharges. FEMALE—Ovaries—Tubes—Pelvic Cavity—Uterus—Vagina (*Examination with Speculum*)—Urethra (*Endoscopic Examination*)—Bladder (*Cystoscopic Examination and Result of Ureteral Catheterization*)—Abnormal Discharges.

Nervous System.

Sensory Functions.—Sensibility to Touch (*Æsthesiometric Examination*)—Heat—Tickling—Pain—Muscular Sense—Sight (*Ophthalmoscopic Examination*)—Hearing (*Otoscopic and Horological Examination*)—Taste—Smell.

Motor Functions.—Skin Reflex—Tendon Reflex—Voluntary (*Systematic Examination of Muscles*)—Co-ordinating—Electric Irritability (*Faradic, Galvanic*).

Vasomotor and Trophic Functions.—(*Congestion—Pallor—Œdema—Inflammation—Sloughing—Wasting—Perspiration.*)

Cerebral and Mental Functions.—Intelligence (*Hallucinations—Illusions—Delusions—Delirium—Torpor—Coma—Coma-Vigil*)—Attention—Memory—Emotion—Speech—(*Comprehension of Language, heard, seen—Utterance of Language, spoken, written*)—*Röntgen-ray Examination.*

Locomotory System.—Bones—Joints—(*Pain—Swelling—Effusion—Mobility—Röntgen-ray Examination*)—Muscles (*Rigidity—Flaccidity—Cramp—Twitching, general or fibrillary—Hypertrophy—Atrophy—Dynamometric Examination*).

Subsequent History:

DIAGNOSIS:

PROGNOSIS:

TREATMENT:

Medicinal:

Physical: (Electricity, massage, hydrotherapy, etc.).

Dietetic:

Hygienic:

General Directions:

PRACTICAL MEDICINE.

CHAPTER I.

THE INFECTIOUS DISEASES.

ENTERIC FEVER.

Synonyms. Typhoid Fever; Typhus Abdominalis; Gastro-enteric Fever; Nervous Fever.

Definition. Enteric fever is an acute infectious febrile disease characterized by inflammation and ulceration of the Peyer's patches or lymph follicles of the intestine, by swelling and inflammation of the mesenteric glands, enlargement of the spleen and a petechial eruption.

Ætiology. The specific cause of enteric fever is the *bacillus typhosus* of Eberth-Gaffky. This bacillus is to be found in the stools, the urine, the blood, the lymph patches of the intestines, the lymph glands, the spleen, the skin eruption and in the marrow and various organs. It usually enters the organism in infected water or milk or upon contaminated food, such as oysters which have been bedded near sewer exits, or green vegetables which have been fertilized by means of sewage. It is contended by some that the bacillus is air borne and may enter the respiratory system and thus reach the blood. Sewage to be contaminated by the bacillus must have received either directly or indirectly the discharges from a patient suffering from the disease.

Enteric fever is more common in the young adult than in childhood, middle or old age and seems to attack the vigorous and healthy as often as the weak and enfeebled. Men seem more susceptible than women, but this is probably because they are more liable to exposure. The disease is most frequently seen in the late summer and early autumn and may occur in almost any climate. It is commonly endemic but epidemics occur at intervals. One who has once had the disease seldom suffers from a second attack.

Pathology. The most characteristic lesion of enteric fever is the inflammation of the solitary and agminated glands of the small intestine. These glands are first congested and swollen, later they disintegrate and necrose, and the formation of ulcers takes place. When a solitary gland is involved the ulcer is small and round; in the agminated glands it is oval with its long

diameter parallel to the long axis of the intestine. The borders of the ulcers are raised; their bases, which may consist of the submucosa, the muscular coat of the bowel or of peritonæum, are necrotic. The ulcer may erode all the coats of the gut and the peritonæum, and perforation may take place, local or general peritonitis resulting. More usually, fortunately, the ulcer gradually heals but the return of the glandular tissue to normal does not take place. In a number of the patients the large intestine is involved as also may be the appendix. In either of these situations perforation may occur.

Inflammation of the mesenteric lymphatic glands and of the spleen is likely to occur, resulting in increase in the size of these structures. The spleen is usually palpable and may be enlarged to two or three times its normal size. Abscesses have been reported.

Thromboses of the veins may occur, especially of those of the leg. Arterial thrombosis is rare. The pericardium, myocardium or endocardium may be the seat of inflammation due to the infection.

Respiratory lesions, such as inflammations of the larynx, bronchi, or pleura, are not infrequent. Empyema is rare.

The liver is the seat of an acute degeneration, with granular, and at times fatty, changes in its cells. Abscess may occur. The bacillus has been found in the gall-bladder and a typhoid cholecystitis may occur.

The kidneys also undergo an acute degeneration in their parenchyma; rarely there may be an acute nephritis. Abscesses of the kidney are rare. Pyelitis and cystitis may complicate the disease.

Lesions in the nervous system are infrequent, but meningitis has been met as also has cerebral abscess.

Abscesses in various parts of the body, notably under the periosteum and in the parotid gland, are not uncommon.

Course and Symptoms. The incubation period is usually about two weeks, and may be accompanied by lassitude and lack of appetite. Occasionally the patient may continue up and about after the onset of the disease (walking typhoid). The inception of enteric fever is gradual, with headache, general bodily pains, nausea and vomiting and a rise of temperature. Chilly feelings may occur, but a distinct chill is rare. There may be nose-bleed and slight bronchitis, evidenced by cough. In children the onset is more usually acute. The bowels may be loose or constipated. There may be abdominal tenderness and distention. About the eighth day the eruption, consisting of small isolated, rose-colored, slightly elevated round or oval spots of about 2 to 4 millimeters in diameter, appears. These disappear on pressure but reappear when the pressure is removed. They are seen earliest upon the back, and slightly later upon the chest and abdomen. They may be found upon the arms and thighs, but very rarely upon the forearms and legs. They appear in successive crops, each crop lasting 2 to 4 days,

while the eruptive period lasts from 2 to 21 days. Relapses show a fresh eruption and the spots may appear during convalescence.

The course of the disease usually lasts about four weeks and to each week belong certain symptoms.

The typical temperature of enteric fever is as follows: After the chill at onset the temperature rises and during the week following it is high at night and lower in the morning, but day by day the differences between these temperatures become less. During the second week the temperature is continuously high and there is little difference between that of the morning

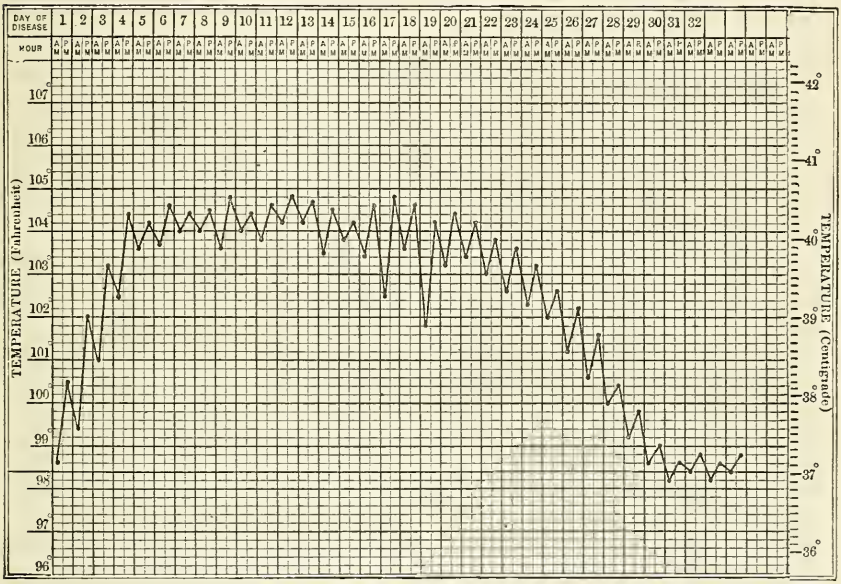

FIG. 1.—Clinical chart of enteric fever of four weeks' duration without complications and showing the temperature as uninfluenced by baths or other treatment.

and that of the evening. In the third week the morning temperature becomes lower while that of the evening remains as high as during the second week. The typical fourth week temperature is one in which the morning temperature falls gradually lower and that of the evening does likewise, dropping to a lower level each day until both it and the morning temperature reach normal.

Complications may alter the course of the temperature. Intestinal hæmorrhages are usually followed by a rapid and distinct fall. The height of the temperature is commonly in direct proportion to the severity of the infection and usually in fatal instances, unless death results from one of the complications

above mentioned, the temperature remains high until death takes place; infrequently, however, death may supervene without the temperature ever having reached a very high level.

The pulse usually bears a direct relation to the temperature curve. In the first week it is full, tense and strong and from 90 to 100 per minute; during the second week, especially in severe infections, it is likely to become rapid, feeble and possibly dicrotic.

Various departures from the typical temperature are not rare. When the disease begins with a chill the temperature may rise at once as high as 103° F. or 104° F. (39.5°–40° C.). Not infrequently does defervescence take place at the end of the second week and the temperature fall to normal within 24 hours. A temperature higher in the morning and lower in the evening may occur but has no especial significance. Sudden falls in temperature usually indicate an intestinal hæmorrhage or perforation. Hyperpyrexia is rare but may be observed just before death. Chills may occur, as stated, at the onset of the disease; at intervals during its progress; with the incidence of complications; after the use of antipyretic drugs or baths; or during convalescence with no assignable cause.

The chills may be accompanied by sweating, but profuse diaphoresis is rare, though at times the abdomen and chest may be moist, especially during the reaction from a bath.

Rises of temperature after defervescence (recrudescences) may take place even after there has been no febrile movement for several days. These may continue for a number of days and then cease. Accompanying them there is no constitutional disturbance, but they call for increased vigilance on the part of the physician. They are usually the result of improper feeding, constipation or mental excitement.

Certain patients in whom convalescence has apparently become established continue to show an evening rise of temperature of one or two degrees (F.). This may be due to starvation but should cause the physician to search for complications, particularly abscesses. In excessively nervous patients such an evening rise is frequent, but if no other symptoms are manifest it may be disregarded and it often disappears if the patient is allowed to sit up, is given small amounts of solid food and the use of the thermometer is discontinued.

Relapses are due to a fresh infection with the *bacillus typhosus* and last varying periods of time; as a rule they are shorter in course than the original attack. The temperature rises and declines gradually and is accompanied by a return of the symptoms.

Afebrile enteric fever has been described by certain observers but is apparently of rare occurrence.

The facial appearance of enteric fever has been described as typical. Early

in the disease the face is flushed and the eyes are bright; by the beginning of the second week the expression becomes apathetic and at the height of the disease it is dull and listless—the typhoid facies. The lips and cheeks may retain a good color throughout the disease.

The typhoid tongue is at first moist with a white coat down its center. Its edges and tip are red. In mild infections the tongue continues moist but in severe types of the disease it becomes dry, brown, cracked and glazed in the later weeks. Sordes may make its appearance. As convalescence progresses the tongue gradually assumes its normal condition.

The spleen is regularly enlarged, soft and may usually be palpated without difficulty.

Unusual Modes of Onset. a. Ambulatory or walking enteric fever: In this type of the disease the patient remains up and attempts to go about his usual occupation. He realizes that he is not in perfect health but feels hardly ill enough to go to bed. When he is first seen by the physician he may have a high fever and a well-developed rash. These infections often prove severe because of lack of proper treatment in the early stages.

b. With marked gastro-intestinal symptoms: The nausea may be severe and the vomiting almost continuous and very difficult to control. Profuse diarrhœa may be present.

c. The usual cough accompanying the onset may be much accentuated and the chill and pain in the side of such character as to suggest pneumonia.

d. With symptoms referable to the kidneys: Rarely we may observe an onset distinguished by bloody urine containing albumin and casts.

e. With pronounced nervous symptoms: Agonizing and obstinate headache or facial neuralgia may be initial symptoms. In certain instances when the patient has continued about during the early weeks delirium may be the first marked symptom. Rarely the disease may begin with muscular twitchings or convulsions, stiffness of the neck and photophobia. Drowsiness, apathy and stupor may exist for some days before other and more typical symptoms develop. Very infrequently is mania the first symptom. In alcoholic patients the various nervous manifestations are especially marked.

f. Intestinal hæmorrhage or perforation may rarely occur as symptoms of onset.

Each week of the course of enteric fever in a typical instance is marked by a special set of symptoms. During the incubation period—varying from 10 to 21 days, usually about two weeks—the patient suffers from indefinite malaise, nausea, headache and general soreness.

First Week. The invasion of the disease is marked by chilly feelings, more rarely by a distinct chill, severe frontal headache and pains in back and limbs; the tongue is coated down its center, its edges and tip are redder and the papillæ more prominent than normal. There often is spontaneous

nose-bleed and there is likely to be cough due to slight laryngitis or bronchitis. The eyes are suffused. The patient is thirsty and often conscious that his temperature is elevated. He complains of weariness, insomnia and nausea which is often accompanied by vomiting. Constipation is the rule but diarrhœa may be present. There may be sore throat with discomfort on deglutition. During this stage of the infection the patient may continue up and about, but usually he finds that he is more comfortable in bed. The course of temperature has been described; by the fifth or sixth day it reaches an evening elevation of 103° to 103.5° F. (39.5° to 39.8° C.). The pulse is rapid, strong and tense, 90 to 100 per minute. Very rarely is it dicrotic. By the end of the week the typical enteric facies is evident. A few spots may be seen and the spleen may be palpable.

Second Week. As the second week progresses all the symptoms become more marked with the exception of the headache and other pains and the nausea and vomiting; these usually cease. The temperature continues high (103°–104° F.—39.5° to 40° C.) with slight morning remissions. The pulse becomes softer, feebler and more rapid (100–120). Bodily weakness is pronounced. The tongue is dry, brown and tremulous; there is likely to be diarrhœa, 3 to 5 thin, pale, yellowish-brown movements a day (pea-soup stools). Mild delirium may appear late in this week; at first it is present only at night, later it lasts through the day as well and the patient shows other effects of the toxin of the disease upon the nervous system, such as photophobia, slight deafness and muscular twitchings. If there is no delirium the patient lies in a lethargic condition, takes no interest in his surroundings and makes no requests.

Third Week. The symptoms of the second week continue and become more pronounced. The temperature continues high, but as the week nears its close, the morning temperature is likely to fall to a lower level (101°–102° F., 38.4°–38.8° C.). The pulse may become very rapid and weak and dicrotism may be manifest. The tongue becomes more dry and cracked and the patient may be unable to protrude it. Bed sores may appear and retention of urine and incontinence of fæces may occur. The symptoms of cerebral poisoning become more marked, the muscular twitchings (*subsultus tendinum*) are more noticeable and the patient may pick at the bed coverings or grasp at imaginary objects. Intestinal hæmorrhage may be evidenced by blood-tinged stools or blood in considerable quantity may flow from the rectum, leaving the patient in collapse with a sudden fall in temperature, imperceptible pulse and other symptoms of extreme weakness. Pulmonary congestion or pneumonia may complicate the disease during this week. Meteorism is not rare. The patient may die or continue to the

Fourth Week. Now the morning temperature falls still lower and the evening rise gradually becomes less until the former reaches normal and the

latter 101°–102° F. (38.4°–38.8° C.). As the temperature diminishes the other symptoms gradually ameliorate, the tongue loses its dry, cracked appearance and becomes moist, the pulse is stronger, the nervous manifestations disappear, and the appetite becomes more vigorous.

Fifth Week. The patient may immediately proceed to complete recovery, the febrile movement may last two or three weeks longer, or after a normal temperature lasting several days, a relapse may take place.

Convalescence is slow. The patient is extremely weak although he may feel well and be very hungry. He is able to sit up but for a few moments at a time and walking is quite impossible. Relapses may be brought on by errors in diet or by over-exertion. The patient often loses his hair for a time and it usually is a number of months before full strength is recovered. Dysmenorrhœa is a common sequel in women.

Menstruation usually takes place as in health during the first or second week, but later and in convalescence it may be absent. Pregnant women, though they seldom contract the disease, often abort during its course.

Complications. *Thrombosis* of the veins, more particularly of the left femoral—although it may occur in both femoral veins—takes place in about 1 percent. of all cases. Recovery is the rule unless emboli dislodged from the clot find their way to the heart, in which case sudden death takes place. There is usually phlebitis of greater or less extent as well as thrombosis, and *arterial* thrombosis is a possible occurrence. The *bacillus typhosus* has been found in the thrombi.

Hæmorrhage from the bowel is a serious complication and is the result of the erosion of a vessel wall by the ulcerative process. It is said to occur in about 5 percent. of the cases. It is by no means necessarily fatal, recovery having taken place after the loss of large quantities of blood *per rectum*. Such a hæmorrhage is evidenced by rapid drop of temperature, pallor, coldness of the extremities and other symptoms of collapse.

Perforation is also marked by a sudden fall in temperature as well as by severe abdominal pain and symptoms of collapse. The pain is rarely localized but is usually general over the whole abdomen. This is a markedly fatal complication, the only chance for recovery being immediate surgical interference; otherwise general peritonitis results.

Peritonitis without perforation may occur by extension of the inflammation within the intestine to the peritonæum surrounding it. It is a grave, though not necessarily fatal complication.

Parotitis followed by suppuration is rare. The infection reaches the gland by means of Stensen's duct.

Cancrum oris may complicate or follow the disease in children. Gangrene of other parts may occur but is rare.

Pneumonia due either to the *bacillus typhosus* or the pneumococcus may

occur either early or late in the disease. In the later weeks hypostatic pneumonia may complicate the course of the infection.

Suppuration in various parts of the body as a result of enteric infection is not rare. The most common situations are the middle ear, the periosteum, the urinary bladder and the gall-bladder. Furunculosis is not uncommon. The pus of these lesions usually contains the *bacillus typhosus*.

Osteitis and perichondritis are common. These may result in necrosis.

Typhoid spine is a rare complication and is the result, in all probability, of an inflammation in and around the bodies of the vertebræ.

Cholelithiasis as a sequel of typhoid fever is well-recognized. It is probably the result of changes in the gall-bladder or in the biliary secretion due to the presence of the *bacillus typhosus* and which facilitate the formation of calculi.

Neuritis is fairly common and may occur during the course of the disease or in convalescence. Its onset is marked by great tenderness along the course of the affected nerves. There may be a slight degree of paralysis, usually involving the extensor muscles of the limbs and evidenced by wrist and foot-drop.

Endocarditis, pericarditis and pleuritis are infrequent complications.

Bed sores may develop in severe cases and in those not well cared for. They are a dangerous and unnecessary complication.

The Blood. During the course of enteric fever the red blood cells and hæmoglobin are diminished; during the early weeks the diminution is gradual. As the temperature becomes normal this diminution takes place more rapidly. The red corpuscles are usually fewest when convalescence begins and as recovery progresses they increase in number. The hæmoglobin percentage is usually lower than the number of red cells would lead us to expect and it increases more slowly than does the number of erythrocytes.

The leucocytes early in the disease show a diminution, in a very large percentage of patients they are less than 7,000 per cu.mm. Non-typhoid complications do not seem to diminish this tendency to hypoleucocytosis. Hæmorrhage and perforation are followed by an increase in the white cells. It may be considered that a leucocyte count above 12,000 at the beginning of an illness is strong evidence against enteric fever. The leucocytes diminish as the disease progresses, reaching the minimum at the termination of the febrile movement, and, as convalescence is established, beginning to increase again.

Cold baths seem to temporarily increase the number of leucocytes but this is believed to be due to a tendency upon their part to seek the surface capillaries rather than a true leucocytosis. A sudden increase in the number of leucocytes is considered to be a warning of threatened peritonitis or perforation. In complicating suppurative conditions there is, as one would expect, a leucocytosis.

During the disease the blood contains the *bacillus typhosus* and this organism may be cultivated from it, which fact may be utilized in diagnosis.

The Widal reaction is based upon the fact that the blood-serum of persons suffering from enteric fever possesses the property of arresting the motion of and agglutinating the causative germ. This reaction exists in over 95 percent.* of cases and is a valuable diagnostic aid. It is seldom observed before the patient has been ill enough to have been in bed for from 5 to 7 days. At times the reaction is not present until after the establishment of convalescence. If it is not obtained upon the first attempt, others should be made at intervals. The reaction may disappear after the cessation of the pyrexia or it may persist for months or even years.

The urine in enteric fever is dark in color, high in acidity and specific gravity, and may contain albumin and casts. The *bacillus typhosus*, in a large percentage of patients, is present in the urine, appearing therein usually in the second or third week and persisting into the period of convalescence. At times these organisms may continue to be present for many months, probably being propagated in the bladder. Their presence is of no importance in prognosis.

Ehrlich's diazo-reaction is so often present in the urine of enteric fever that its aid in diagnosis should always be invoked. It is not pathognomonic, since it may occur in other conditions. It is usually present early in the infection.†

Prophylaxis. The prevention of enteric fever resolves itself primarily into the destruction of the specific bacillus, or failing this, the prevention of its entrance into the human body. All excreta, fæces, urine, pus from abscesses, etc., as well as all bed clothing, bath waters and all utensils which have in any way come into contact with the patient should be properly disinfected or disposed of in other ways.

The fæces should be passed into glass or porcelain vessels and must be thoroughly macerated and allowed to stand for at least one hour mixed with a freshly prepared disinfecting solution such as calcium chloride, four ounces, water, one gallon. The urine should stand for ten minutes mixed with one-tenth of its volume of mercury bichloride 1 to 1,000. Sputum should be expectorated into vessels containing phenol 1 to 10, or the lime solution given above. Bath water and remnants of food should be disinfected with lime or phenol solution. Bed linen and clothing, before being sent to the laundry, should be immersed in a solution of phenol 3 to 100, or boiled in soapsuds to which washing soda has been added. Pus dressings and the like should be burned.

The sick-room should be disinfected in the manner customary after the infectious diseases.

* Simon.

† For technique of the Widal and Ehrlich reactions see works on laboratory diagnosis.

Since the *bacillus typhosus* usually enters the system by way of the mouth too great care cannot be taken to be certain that all ingested substances are above suspicion.

The specific bacillus of enteric fever being excreted in the urine naturally necessitates the thorough disinfection of this fluid as is suggested in a previous paragraph. An additional safeguard in this connection is the administration of hexamethylenamine (urotropin) in doses of 7½ grains (0.5) three times daily. This drug is believed to render the urine sterile since it is excreted in this fluid as formaldehyde. This means of safeguarding the public health should never be neglected; rendering the urine free from infective properties is also important from the standpoint of the patient and is not to be neglected in the treatment of the disease. The administration of the drug should be begun not later than the third week of the affection and should be continued for several weeks into convalescence.

Anti-enteric inoculation has been attempted by various experimenters and the result of their observations may be summed up in the statement that the measure is one which, in properly selected cases, is fraught with little or no danger, and, so far as we are able to judge, one which should not be neglected when there is probability of exposure to the infection of the disease.

Treatment. In the treatment of typhoid fever it is of the greatest importance that all patients should be strictly confined to bed during the febrile stage of the disease and well beyond this into convalescence. In a private house the bed should, when possible, be in a large, well-ventilated room from which all hangings and superfluous furniture have been removed. The temperature should not be above 60° F. (15.5° C.) and in favorable weather the windows should be open. Too bright light and too much darkness are to be avoided. The bed should not be too heavily covered, and the bed linen must be kept perfectly smooth and frequently changed. In severe infections the air or water bed may be necessary. Early in the disease dorsal decubitus is the best position, but later the patient may be encouraged to change his attitude lest there be any tendency to pulmonary hypostasis. The mouth, teeth and tongue should be frequently cleansed. Studious attention should be given to the proper cleanliness of the body and all points at which bed sores are likely to develop must receive special care. The bowels and bladder should be evacuated only when the patient is lying on his back.

Since febrile diseases actively consume the body proteid this loss must be supplied in so far as possible, by nourishing food. The fact that the digestive fluids are altered makes this a complicated problem and the pathological changes in the digestive tract add to the difficulty. During the febrile movement of typhoid fever, and usually for some time thereafter, fluid diet should be strictly enforced. If the patient has a lack of appetite the physician may

combat this by careful variation of the diet in accordance with the tastes of the patient. Cold drinks need not be restricted, water, plain or with fruit juices, natural mineral waters containing not too much carbon dioxide, and cold tea may be allowed.

Milk is the most perfect food, though some patients object to it and others do not bear it well for any length of time. In such instances it may be diluted with plain water, mineral water or lime water, or to it may be added tapioca or arrowroot. If milk appears undigested in the stools too much has been administered; the quantity should be lessened and broths should be given. Buttermilk, peptonized milk, thin barley gruel and albumin water are allowable. Simple ice-cream made of milk with the addition of a little sugar and vanilla may prove acceptable. Often the artificial infant foods, meat broths and bouillon are useful and well borne.

One week after the cessation of the febrile stage the patient may be given solid food; at first toast, a soft egg, scraped beef, to be followed a few days later by roast fowl and purée soups. At the end of the second afebrile week, steak, chops and green vegetables may be added. Some patients, after the acuity of the disease has subsided, continue to have an evening rise of temperature of two or three degrees (F.); to such, if the nourishment is impaired and the need of food is manifest, we may allow a gradual return to solid diet. Usually the temperature promptly subsides and no harm is done.

The specific treatment of typhoid fever by means of an antitoxin has as yet given no very favorable results. The difficulty in the preparation of an antityphoid serum is that typhoid fever, unlike diphtheria, which is merely a toxæmia, is more especially a bacteriæmia. The problem, therefore, is the production of a serum which is principally bactericidal, though it probably must be, to a certain extent, antitoxic as well.

Chantemesse, in his latest reports upon the serum treatment of this disease, claims that by the use of a serum taken from horses which have been immunized by the injection of a soluble enteric toxin he has reduced the death rate to four or five percent., as against a mortality of eighteen percent. in other hospitals in Paris where the cold bath treatment only is used. He states the interesting fact that patients profoundly poisoned by the disease should receive small doses of the serum as against the large doses given in mild infections. He uses cold bathing in connection with his serum and considers the prognosis under this form of treatment best when the injections are begun early in the disease.

Much experimentation has been done by various observers along the lines of serum treatment but this apparently has resulted in the production of only a very slight influence on the disease and, as regards therapeusis, little more has been proven than that the treatment is harmless.

Treatment by Elimination and Intestinal Antisepsis. From the time

that enteric fever was recognized as a distinct disease, and more particularly since it was demonstrated to be of bacterial origin, the eliminative and antiseptic treatment has been foremost in the minds of advanced clinicians. The only questions have been, can the antiseptic treatment be efficient, and, how shall we best secure its efficiency? An extended experience shows that many patients may be treated effectively by the use of such insoluble antiseptics as naphthalene, the various preparations of salicylic acid and bismuth naphtholate or tetraiodophenolphthaleinate. Of these the two bismuth salts are to be preferred. The bowels should be first flushed with calomel followed by a saline, and then the bismuth salt should be administered in divided doses of from 90 to 120 grains (6.0 to 8.0) per day. If the disease is not inhibited in the first week of the exhibition of these salts the problem is complicated by the fact that the infection has become systemic. We must now administer an antiseptic which will be disseminated as far as the blood goes and which can permeate every organ and tissue.

At present the administration of the compound solution of chlorine accomplishes the purpose better than that of any other drug. It should be given in doses of one drachm (4.0) every three or four hours. In such dosage it may be given until complete disinfection of the alimentary tract is obtained; not only this; it is also taken up by the blood, as is proven by the fact that free chlorine has been found *post mortem* in the ventricles of the brain, and combats the infection there.

All the chlorine is not changed in the stomach into alkaline chlorides, but some passes through the intestine in its original form for its odor can be detected in the fæces. It is not irritating to the mucous membranes of the gastro-intestinal tract.

The author considers that there is nothing in medicine more striking than the clearing up of the tongue, the improved mental condition, the lessened local disturbances and the general betterment which chlorine brings about in enteric fever and especially is it effective in the severer forms of the disease.

In concluding the discussion of the treatment by chlorine it may be safely asserted:

1. That in the treatment of enteric fever chlorine can be safely administered, without fear of digestive or other disturbance, until the alimentary tract has been completely disinfected.

2. That under its use the tongue becomes cleaner, the appetite and digestion better, the fever lower and the stools devoid of odor save that due to the chlorine.

3. The general strength, intellectual processes and nervous conditions improve.

4. The duration of the disease is shortened and the patient usually proceeds to a rapid and complete recovery.

The mortality should not be greater than 2 percent.

Complications are rare because this form of treatment limits the infection.

In children it is better to begin the administration of chlorine early in the disease, no preliminary treatment by means of the insoluble intestinal antiseptics being necessary or advisable.

During the course of the disease elimination is encouraged by the use of high rectal irrigations of 1 gallon (4 liters) of normal (0.9 percent. sodium chloride) saline solution. The tube should be gently passed into the rectum for at least a foot, the bag or irrigator should be three feet above the patient, and the temperature of the solution 112° F. (44.5° C.). The irrigations should be given twice a day. They hasten the elimination of toxins, keep the bowels active and have a considerable stimulant effect upon the patient.

If constipation is present sufficient magnesium sulphate to keep the bowels freely open should be prescribed.

Treatment by Means of Cold Baths. At the present time the treatment of enteric fever by means of the Brand, or more properly the Currie-Jürgensen bath is enjoying considerable vogue. The history of this method is a curious one. In the early period of the use of this method it was advocated because it was thought that it reduced the fever. When it became apparent to anyone who made careful observations that its effect upon the fever was transient, that almost as frequently the temperature rose after the bath as fell, this theory became untenable and was abandoned. But tubbing was continued without theory. Later the patients were subjected to the bath on the ground that it was a nerve stimulant. The truth of this hypothesis can hardly be affirmed or denied for it can neither be proven nor disproven. When this theory was rejected the baths were continued as before. The last and present theory is that bathing increases the elimination of ptomaines. The baths certainly are diuretic, but that they eliminate ptomaines is incapable of proof because at present we have no method by which ptomaine elimination can be accurately measured. It has been said that the urotoxic co-efficient is increased after the baths, but it is perfectly safe at the present time to say that until chemistry shall afford a method of obtaining quantitative and qualitative results as to the toxins found in the urine all theorizing as to the increased urotoxic co-efficient must be absolutely worthless as a guide to clinical procedure.

Much as the author deprecates the continued popularity of the cold bath treatment it is meet that it should receive proper description in a work of this nature.

Brand's original method has been so modified that the consensus of opinion of the advocates of this form of treatment seems to be in favor of tub bathing at a temperature of from 80°–90° F. (26.5° to 32.5° C.), although certain authorities believe that tubbing at 98° F. (36.5° C.) produces quite as good results and is much less disturbing to the patient.

The technique of the procedure may be described as follows: To carry out the process properly at least two attendants are necessary, for the patient must be lifted into the tub which is placed at his bedside. The tub should contain water enough to cover the patient to the neck, the head should be supported upon a rubber air pillow attached to the edge of the tub and his comfort will be augmented by placing a rubber air cushion beneath the buttocks. If the initial plunge into the cold water be disagreeable the bath may be begun at a comfortable temperature and cold water may be gradually added until the temperature is reduced as low as required. It is better, however, to use cold water from the beginning for the effect sought is a reaction and for this a certain amount of shock is necessary. The patient, wearing swimming trunks or covered by a sheet, should be gently lifted by two attendants and lowered into the water. Cold water—60° F. (15.4° C.) or less—should be poured over the head or a frequently changed cool compress should be applied to the forehead. The cold water may be applied to the head by means of an ordinary irrigating apparatus .

Vigorous rubbing of the body by the hands of the attendants is an absolute necessity. The bath should last from 10 to 20 minutes according to the reactive power of the patient. At the end of the procedure the patient should be lifted from the tub and placed on the bed—over which a rubber sheet and a blanket have been previously spread—the water having been allowed to drain off for a few seconds to prevent wetting the blankets. Now, being wrapped in the blankets, he should be thoroughly dried by rubbing. If the patient shows signs of poor reaction while in the bath, such as blueness of the lips and extremities or decided shivering, or if the effect upon the heart is untoward, the duration of the bath should be lessened and its temperature raised. In most patients chattering of the teeth may be disregarded and cyanosis of the extremities alone need not be considered sufficient reason for stopping the bath, but if marked blueness of the face, especially about the nose, be noticed, the patient should be immediately taken from the water. Before the patient is put into the bath and after he is taken out some authorities are accustomed to administer a glass of wine, a half ounce (15.0) of whiskey or a half to one drachm (2.0 to 4.0) of the aromatic spirit of ammonia, diluted, but these stimulants seem hardly necessary as a routine and would better be husbanded against an occasion of real need. During the bath a glass of cold water may be allowed.

The patient's reactive powers may be measured by a tentative bath at 90° F. (32.5 C.), reduced to 80° F. (26° C.) and lasting five minutes, and the initial temperature, the reduction and the length of the following bath may be determined accordingly. If possible the physician should be present during this bath, both to guard against the possibility of shock and to make sure that the good effects of the procedure are not lessened by too early termi-

nation. If the cold tub is not well borne by the patient warm baths given in the same manner are often followed by good results.

In private practice the carrying out of this method of treatment is fraught with difficulty for obvious reasons. It is best managed by procuring an ordinary tin bath tub which may be easily moved from place to place. This, as well as the wheeled tubs used in hospitals, should be filled freshly for each bath.

The preparation of the bed for the reception of the patient after the bath is of utmost importance. All should be ready before the beginning of the procedure, so that should it become necessary to terminate the bath suddenly there may be no delay. Two warm blankets should be provided and several hot water bags as well, and an ice cap should be ready for the head. Under the lower blanket should be placed a piece of water proof cloth, over it a warm sheet upon which the patient should be laid upon being lifted from the tub. The sheet should then be wrapped about him and tucked between the arms and body so that no two skin surfaces shall come in contact. The patient is thoroughly dried by being rubbed outside the sheet. This is then removed and he is allowed to lie between the blankets with the hot water bottles against his feet and the ice cap upon his head.

About 20 to 30 minutes after the bath is over the patient will have ceased to be cold and his temperature should be taken to ascertain the effect of the procedure; it should be taken again three hours after the beginning of the bath in order to learn if a second is necessary, it being the custom to give the cold tubs every three hours if the temperature reaches 102.5° F. (39.1° C.) or more.

The fall in temperature following the bath varies in different patients as well as in the different weeks of the disease. In the first week it may not fall so much as one degree (F.), but in the later weeks drops of from two to three degrees (F.) are common. In addition to the lowering of the temperature the bath is said to mitigate the other symptoms, increasing the strength of the heart, and lessening the tendency toward cerebral disturbance.

Contra-indications to bathing are few. The menstrual period and pregnancy do not contraindicate but at the slightest sign of hæmorrhage, peritonitis or perforation the procedure should be stopped. Extreme heart weakness, marked arteriosclerosis, old age, and complicating pneumonia, pleuritic effusion, or phlebitis are contraindications. Obese patients should be bathed with care. There are certain persons who, for no apparent reason, do not bear tubbing well. In such it is wise to omit the process.

The Bed Bath. In instances where tub bathing is inconvenient or impossible the bed or slush bath may be employed. Many patients to whom the cold tub is almost unendurable bear it well and are favorably affected by it. It is given upon a bed around the edges of which rolled blankets have been placed

so as to form a sort of wall. Over this is placed a rubber sheet and into the trough thus formed several pails of water are poured. The patient is placed in this and treated just as when the tub bath is employed. The bed bath may be constructed also by passing a piece of clothes line around the head and foot of the bed, connecting these by two parallel ropes and throwing over the whole a rubber sheet which is attached to the rope by clothes pins; or a rectangular fence about eight inches in height and slightly smaller than the mattress may be constructed over which a rubber sheet may be thrown. The water from these improvised tubs is best drawn off by a siphon made of a few feet of rubber hose.

The sponge bath is indicated when the temperature is hardly high enough to warrant the more drastic tub bath and yet is sufficiently elevated to cause discomfort. In any case the patient should receive two sponges daily for the sake of cleanliness. The method is as follows: The water may be of various temperatures as indicated; often the addition to it of a little alcohol is grateful to the patient. An ice cloth should be applied to the head and a sponge or soft cloth wet just sufficiently to leave a thin film of moisture on the skin is used; this cools the patient by rapid evaporation and does not wet the bed clothing and with it he is thoroughly rubbed, while the other hand is performing friction, and then dried, one part at a time. Care should be observed to keep the portions of the body not being sponged, covered. Particular attention should be given the back for here the tissues retain heat longest. Proper reaction is evidenced by redness of the skin. No such effect is produced upon the temperature by sponging as by tubbing.

The sprinkle bath as a method for the reduction of temperature may be considered to rival the tub bath. It is better borne by many patients and is of peculiar adaptation to private practice.

The technique is as follows: The head of the bed should be raised about 10 inches from the floor, and, to keep the mattress from sagging, crosswise under it should be placed several boards as long as the width of the bed. The mattress should be covered with a rubber sheet upon which a pillow and ordinary sheet are adjusted. The patient should be stripped and sprinkled with water of the desired temperature from a watering pot or from an irrigating apparatus to the tube of which a sprinkling nozzle is fitted. The water as it flows from the foot of the bed is received in any large vessel and may be used over and over, the proper temperature being maintained by the addition of ice. The water should not be poured from too great a height and should be applied chiefly to the abdomen and legs. Rubbing with the hands should be continued throughout the procedure, otherwise the patient should be dealt with exactly as in tub bathing.

The wet pack is another useful hydrotherapeutic procedure less unpleasant to the patient than the tub. The body from the axillæ to the groins is

wrapped in a sheet which is kept cool enough by repeated wettings to control the temperature.

Antipyretic Drugs. Certain drugs of this class, such as antipyrine, acetphenetidine acetanilide, pyramidon, etc., may be used in excessively high temperatures but they are not to be recommended because of the possibility of their causing cardiac depression. Neither do they, although they may bring about a fall in temperature, act favorably upon the other symptoms of the disease. Lactophenine, in daily dosage of 60 to 75 grains (4.0 to 5.0) may cause a prompt fall in temperature, quiets the nervous system and induces sleep. Quinine and euquinine also cause the temperature to drop, but none of this class of drugs affects the course of the disease and they are not to be recommended save as adjuncts to other forms of treatment.

Treatment by intestinal antiseptics other than chlorine has been frequently advocated. Among the drugs discussed in this connection may be mentioned:

Phenyl salicylate (salol) in doses of from 5 to 10 grains (0.33 to 0.66) four to five times a day. The possibility of injuring the kidneys more than overbalances any possible good effect that this drug can accomplish.

Thymol in the same dosage is open to the same objections.

Calomel as an intestinal antiseptic is practically inert and the good effects reported from its use have doubtless been due to the free purgation in the early period of the disease which its exhibition induces.

Betanaphthol in 5 to 10 grain (0.33 to 0.66) doses three or four times daily, is claimed to be capable of causing intestinal antisepsis without toxic symptoms. Its use is recommended in combination with bismuth salicylate when there is diarrhœa, with magnesium sulphate when there is constipation. It is asserted that under the influence of this drug there is less tendency to abdominal pain and tympanites, the tongue becomes clear and the stools odorless, convalescence advances rapidly and there is a diminished tendency to complications.

Phenol and tincture of iodine, one part to two in doses of one to three minims (0.065 to 0.2) well diluted, three to six times a day have been recommended. Naphthalene is objectionable on account of its large dosage, unpleasant taste and liability to cause strangury. Beer yeast, three teaspoonsful (12.0) in milk per day, has been given in the hope that its micro-organisms might inhibit the growth of the typhoid bacilli in the intestine, but little is to be accomplished by this agent save a checking of the diarrhœa.

Acetozone is the commercial name given to a mixture of benzoyl-acetyl peroxide, an inert absorbent substance. It is administered as an intestinal antiseptic, the daily dosage being 10 to 20 grains (0.66 to 1.33) dissolved in a quart of water. Various observers have reported upon this preparation, claiming that when taken early in the disease and in large amounts the course is shortened to 10 to 12 days. Also under its influence the ab-

dominal, nervous and other symptoms are less marked than usual. There is much difficulty in inducing patients to take sufficient amounts for long enough periods of time.

Treatments by Means of Intestinal Antiseptics and Free Elimination. The object of these methods is to render the alimentary tract as aseptic as possible and to remove without delay the cause and products of the infection. As far as the antiseptic part of the treatment is concerned it differs in no way from the methods hitherto described, but added to these is the free exhibition of purgatives, which are given to carry off the fæcal accumulations, the patients being encouraged to drink large quantities of fluid to replace that removed by purgation.

The simplest of these forms of treatment is as follows: This consists of the daily administration of calomel in ¼ to ½ grain (0.016 to 0.032) every half hour up to six doses; two or three hours later one-half ounce (15.0) of Epsom or Rochelle salts is given. The object is to bring about three to four free movements per day. Phenyl salicylate (salol) in five grain (0.33) doses, every three hours, is the antiseptic used in connection with this treatment. The claims are not excessively extravagant, but it is believed that under this treatment hæmorrhage and perforation are rendered less frequent. The possibility of salivation from the calomel must be considered, but it is not likely to take place, probably because of the frequent movements from the bowels.

Another method of treatment which at one time created a considerable amount of discussion is as follows: Tablets consisting of podophyllum resin 1-960 grain (0.00067), calomel 1-16 grain (0.004), guaiacol carbonate 1-16 grain (0.004), menthol 1-16 grain (0.004), eucalyptol, q.s. were ordered. One of these tablets was given every 15 minutes during the first 24 hours and in larger doses during the second day, if necessary, until at least five or six free defæcations had taken place during the second and third days. On the third or fourth day tablets containing podophyllum resin 1-960 grain (0.00067), calomel 1-16 grain (0.004), guaiacol carbonate ¼ grain (0.016), menthol 1-16 grain (0.004), thymol 1-16 grain (0.004), eucalyptol q.s. were prescribed; one every two or three hours. Both these tablets were given at longer intervals if there was a fall in temperature. On the fourth or fifth day guaiacol carbonate three grains (0.2), thymol one grain (0.065), menthol ½ grain (0.033), eucalyptol five minims (0.33) were administered in capsules, one every three hours alternating with the tablets. This plan of treatment in most instances failed to accomplish the result claimed for it and is now in little vogue.

Treatment of Special Conditions and Symptoms. The mouth and tongue should be kept clean by the employment of regular and frequent washings with diluted liquor antisepticus, tincture of myrrh, etc. A very useful mouth wash consists of equal parts of liquor antisepticus, hydrogen dioxide solution, lime water and water. The mouth should be cleansed after every administra-

tion of food and there is no contraindication to the use of the tooth brush. Sordes and coating upon the tongue may be removed by cotton swabs wet in one of the above mentioned solutions. A convenient tongue-scraper may be constructed of a piece of whale bone bent into a loop. In cases where the tongue is extremely dry the "tongue-bath" often affords much relief. This consists simply in holding the mouth full of fluid for several moments. In this way considerable moisture is absorbed by the mucous membranes.

Heart Weakness. In this condition it is better not to use alcohol unless the patient has been accustomed to the stimulant in health. In such a case it may be employed (brandy or whiskey) in doses necessary to produce the desired effect. As a heart stimulant strychnine—1-60 to 1-15 of a grain (0.001 to 0.004) depending upon the condition to be met—is the stimulant of choice. Extreme heart weakness may necessitate the additional employment of digitalis—the tincture 5 to 10 minims (0.33 to 0.66)—glyceryl nitrate —1-100 to 1-50 of a grain (0.0006 to 0.0012)—or aromatic spirit of ammonia—one to two drachms (4.0 to 8.0.) Collapse may be treated by hypodermatic injections of camphor—one grain (0.065)—in olive oil or æther—15 minims (1.0). Marked asthenia may necessitate the intravenous infusion or hypodermatic injection of normal (0.9 percent.) sodium chloride solution.

Symptoms Referable to the Nervous System. The headache and general pains of the onset may be mitigated by antipyrine salicylate in 10 grain (0.66) doses every two hours, and by hot or cold applications. The delirium may be controlled by the use of the ice cap, and various sedatives, sodium bromide ½ to 1 drachm (2.0 to 4.0), sulphonmethane (sulphonal) 15 to 20 grains (1.0 to 1.33), chloralformamide 20 to 30 grains (1.33 to 2.0), sulphonethylmethane (trional). 10 to 15 grains (0.66 to 1.0); hydrated chloral or morphine may be employed as a last resort, the latter best hypodermatically as Magendie's solution, 10 drops (0.66).

Tympanites may be lessened by the very careful introduction of a rectal tube, through which large quantities of gas are often voided, and by the internal administration of oleum terebinthinæ, 5 to 10 minims (0.33 to 0.66) in capsule. The food should be diminished in quantity as the meteorism is the result of fermentative processes. High rectal irrigations of normal saline are also useful in this connection.

Diarrhœa, if obstinate, may usually be controlled by the use of bismuth, with the addition of opium if necessary.

Constipation is best treated by the use of saline enemata, though certain observers, as will have been noticed in the foregoing sections, have no objection to the use of calomel and other purgatives.

Bed sores should never be allowed to occur and may be prevented by attention to the points where they are likely to appear. The strictest cleanliness must be maintained about the back of the heels and over the buttocks and

sacrum. The sheets must be kept smooth and the bed thoroughly clean and free from crumbs, moisture and contamination from the rectal or vesical discharges. In addition to the maintenance of careful cleanliness, measures should be taken to harden the skin of the susceptible parts. To insure a good blood supply to these the patient should be turned upon his side several times a day and the skin of the back thoroughly rubbed with a dry towel and dusted with powdered talc. Applications rubbed into the skin to harden it, such as salt, two drachms (8.0), to whiskey, one pint (½ litre), or a dilute solution of lead subacetate may be employed. When the skin becomes red and irritated, but is still unbroken, it should be painted with a solution of silver nitrate, 20 grains (1.33) to one ounce (30.0) of water. When the bed sore has appeared, with the object of preventing its spread and of accelerating its cure, the patient must be so placed as to take all weight from the affected part; this may be accomplished by the use of a rubber bed ring. The sore itself must be kept clean by swabbing with 1 to 5,000 mercury bichloride solution and dusted with iodoform. A dressing of zinc oxide ointment spread upon gauze may be applied. In marked instances the use of the water bed may become necessary. If the sore spreads or burrows through the surrounding parts free opening and thorough irrigation are indicated.

Complications should, in general, be treated as when occurring independently, but the treatment of intestinal hæmorrhage, peritonitis and perforation needs special consideration.

Upon the appearance of any symptom suggestive of *hæmorrhage* all hydrotherapeutic measures should be stopped immediately and absolute quiet insisted upon. An ice coil should be applied to the abdomen and the food should be of the most non-irritating character; it is often wise to stop feeding entirely for six or eight hours. If the hæmorrhage is extreme a hypodermatic injection of from ¼ to ⅓ of a grain (0.016 to 0.022) of morphine should be given and the foot of the bed should be elevated. The administration of morphine or opium has the disadvantage that it may mask the symptoms of a concurrent perforation of the intestine and on this ground certain clinicians consider it better omitted. If symptoms of collapse are present hypodermatic stimulation by means of æther or camphor with sterile oil is necessary. In this connection hypodermatoclysis of hot normal saline solution or direct infusion into a vein is also useful. The most efficient drug in the control of the hæmorrhage is calcium lactate in doses of 20 grains (1.33) three times daily. Calcium chloride is also effective, both these substances having a decided influence in increasing the coagulability of the blood. Their use should not be continued for more than three or four days for their more protracted administration is likely to result in a diminution of the blood's coagulability. Gelatin in doses of 75 to 120 grains (5.0 to 8.0) has been recommended in the treatment of hæmorrhage, and ergot—½ drachm (2.0) of the

fluid extract—also has its advocates. Internal styptics such as tannic and gallic acids, lead subacetate, etc., may be employed but their effect is problematical.

Perforation of the intestine and peritonitis necessitate early operative treatment and by this means many patients are now saved who under less radical treatment would formerly have died. The earlier the operation is undertaken after the establishment of the diagnosis the better are the chances of recovery. Operation should be performed even in desperate instances and when the condition is obscure an exploratory incision is advisable, the resistance to the shock of operation being usually good in typhoid patients.

Such surgical complications as periostitis and cholecystitis often recover without operation but when the presence of pus is clearly demonstrable radical treatment should be undertaken.

Neuritis following enteric fever is frequently characterized by paralysis and although its symptoms may persist for months, as a rule recovery takes place under the influence of massage, electricity and general tonic treatment.

The so-called typhoid spine may prove an obstinate sequel of the disease; it is usually accompanied by a neurotic condition of the patient and requires practically the same treatment as neurasthenia, namely, rest in an institution where anxious and sympathetic friends are not given access to the patient, hydrotherapeutic measures, massage and proper exercises. The application of the acutal cautery may prove effective.

During *convalescence* the patient should be guarded against recrudescences and relapses, the treatment of which, should they occur, is practically the same as that of the original attack.

With regard to diet it may be stated that if the patient's nutrition remains good it is best to allow no solid food before the 7th to the 10th day after the return of the temperature to normal; solid food may be permitted earlier than this to patients who are weak and much emaciated and in certain instances a persistent slight afternoon fever has been known to subside upon giving the patient simple solid food. The danger of inducing perforation by the too early administration of solids, however, must not be forgotten and the same is true of too early muscular exertion. The first solid foods usually allowed are scraped raw beef sandwiches, soft boiled eggs, milk toast, boiled rice and other cereals. These should be given tentatively and with caution at first, and if no ill-effects follow, their quantity may be increased and a gradual return to ordinary diet permitted.

As stated, muscular exertion should be undertaken with great care and any excess of this, as well as of emotional excitement, should be studiously guarded against upon the ground that recrudescence may follow.

Protracted diarrhœa is often due to the presence of an unhealed ulceration,

and in view of possible perforation, the patient should be kept in bed and on a fluid diet until there is evidence that the lesion has disappeared which will usually take place if bismuth naphtholate or tetraiodophenolphthaleinate is prescribed in doses of about 5 grains (0.33) three or four times daily in connection with astringent injections such as those advised for the treatment of ulcerative colitis.

Obstinate constipation is better treated by simple enemata than by drugs.

With regard to the time when the patient should be first allowed to sit up, in general it may be said that by the end of the first week after the return of the temperature to normal he may be moved to a chair for a gradually increased time each day and after a few days he may venture upon his feet and walk about slowly. Little by little he may resume his ordinary mode of life.

PARATYPHOID FEVER.

This is a term applied to a group of diseases which in clinical course closely resemble true enteric fever.

Ætiology. The cause of these affections is a micro-organism intermediate between the *bacillus typhosus* and the *bacillus coli*, and which closely simulates or is identical with the *paracolon* bacillus. The modes of infection are probably similar to those of enteric fever.

Pathology. The morbid changes found in these affections consist of constant splenic enlargement and intestinal ulcerations resembling those of dysentery rather than those of enteric fever. The solitary and agminated follicles and the mesenteric glands are not involved. Rose spots have been observed.

Symptoms. The incubation period is shorter than that of enteric fever and the onset, which may be preceded for several days by prodromata such as malaise, headache and torpor, is usually more sudden. The lethargy appears earlier and this symptom as well as the headache is, as a rule, more marked. The temperature rises more rapidly than in enteric fever; an initial temperature as high as 104° F. (40° C.) has been noted. Splenic enlargement and rose spots occur. The course of the disease varies; it may be short or in other instances, prolonged; convalescence is usually shorter than in enteric fever; relapses may occur.

The differentiation from enteric fever is based upon the absence of the Widal reaction and the causative micro-organism may be cultivated from the fæces, urine, the blood and from the rose spots.

The disease may result fatally, but most patients recover.

The prevention of paratyphoid infections is identical with that of enteric fever.

Treatment. This is essentially the same as that of enteric fever with the exception that the serum employed in specific treatment must of necessity be a product of the growth of the paracolon bacillus.

MOUNTAIN FEVER.

Synonyms. Rocky Mountain Fever; Spotted Fever.

Definition. An acute infectious disease characterized by a rather sudden onset with a chill, a purpuric eruption and a high fever terminating in from two to seven weeks by lysis.

Ætiology. The disease occurs in the Rocky Mountain regions of Idaho, Montana, Wyoming and Nevada; it is especially common in the Bitter Root Valley and along the course of the Snake River. It is most prevalent in the spring and early summer months, being very rarely observed at other seasons. Males are more commonly affected than females, probably because the occupations and habits of the former render them more liable to infection, and the disease most usually attacks individuals in early or mature adult life. It occurs less frequently in children. Persons who live in farming or grazing districts and those who spend most of their time in the open air, as carpenters, engineers, bridge builders and individuals of similar occupation who are engaged in railroad and canal construction, seem most prone to acquire the infection.

Certain observers who reside in regions where the disease is frequently seen have considered its specific cause to be the *pyroplasma hominis*, an organism nearly related to the *pyrosoma bigeminum,* the cause of Texas cattle fever; they state that this parasite is found within the body of the red blood cells of individuals suffering from the disease and is transmitted to the patient by means of the bite of a variety of tick, the *dermacentor reticulatus.*

Prolonged study of the blood and red cells of infected subjects by other observers has failed utterly to show the presence of pyroplasmata and has left the true cause of the disease in doubt; it seems, however, probable that the specific organism, if present in the blood, must be one very difficult of demonstration and one necessitating the employment of special methods of experimentation for its identification.

Inoculation experiments with the blood of patients suffering from the affection have proven that the disease may be transmitted to guinea-pigs and monkeys since the fever, duration and skin manifestations exhibited by these animals after such inoculations simulate closely the symptoms exhibited by the human being.

Even if the theory that mountain fever is not due to a pyroplasma, and in the light of our present knowledge it would seem that it is not, it is possible that the disease may be transmitted by means of a tick bite since it is prob-

able that ticks may act as the hosts of other pathogenic micro-organisms than pyroplasmata.

Pathology. The morbid changes observed upon autopsy consist of the cutaneous manifestations, which will be described in a later paragraph. In guinea-pigs, in addition to the skin phenomena, enlargement and a hæmorrhagic condition of the scrotum have been observed by Ricketts, together with swelling of the testicles, congestion of the epididymis, retention of the urine, distention of the seminal vesicles, congestion of the kidneys and suprarenal glands, swelling and congestion of the spleen and liver and an enormous engorgement of the right heart and venous system. Meningitis and localized inflammatory conditions were observed in instances in which the skin of the swollen scrotum had become gangrenous and there was consequent staphylococcus infection of the underlying tissue.

Symptoms. The period of incubation is indefinite but probably varies from three to ten days; if the tick bite is a factor in the ætiology of the disease the symptoms may appear very soon after the infection, for patients have been reported who have exhibited the heads of ticks imbedded in the skin. The prodromal symptoms consists of malaise, nausea and sensations of cold. The invasion of the disease is marked by a distinct chill, followed by an abrupt rise of temperature which by the second day reaches 103° to 104° F. (39.5°–40° C.) and by the eighth to the tenth day may increase to an afternoon maximum of 105° to 107° F. (40.5°–41.6° C.). The morning temperature is slightly lower than that of the evening. About the middle of the second week the temperature falls by lysis, usually reaching normal by the fourteenth day. With the initial rise in temperature there is generally pain in the body and limbs; during the second week nose-bleed, more or less severe in character, occurs; the tongue is coated down the middle, red at the tip and edges and in severe infections may become dry, brown and cracked; sordes may be observed; nausea and vomiting and usually constipation are present. The urine is scanty, dark, and contains an increased amount of urates; albumin and casts may be present. The spleen and liver are increased in size and the conjunctivæ may be of sub-icteroid hue. The pulse is weak and rapid; the respirations are rapid and regular but shallow. They may reach 60 per minute but are usually about 40. Bronchitis may develop at the end of the first week. In severely infected patients the mental condition may resemble that of enteric fever. The leucocytes may be slightly increased, there is destruction of the red cells and diminution in the amount of hæmoglobin.

The eruption appears from the third to the fifth day, first upon the wrists, ankles or back, thence it spreads to the arms, legs, forehead and body, the abdomen being last involved. The spots may appear so rapidly as to cover all the skin within twelve hours, but usually two to three days pass before the height is reached. The rash first consists of bright red circular spots from

the size of a pin point to that of a pea and resembles the eruption of enteric fever; the spots are not elevated and in the beginning disappear on pressure; they may be tender and in severe types of the disease are dark blue or purplish in color, and increase in size until the skin takes on a mottled appearance; before disappearing they may assume a greenish-yellow hue. The spots begin to fade at the end of the first week and lose their petechial character as the fever declines. Desquamation begins during the third week but the spots may not wholly disappear for weeks or months. The skin may become jaundiced or gangrenous over the elbows, fingers, toes or scrotum. In marked infections the spots coalesce and the skin takes on a mottled appearance which is quite typical of this disease.

The diagnosis. The appearance of the patient is quite characteristic and those who have seen a few patients suffering from it find little difficulty in recognizing the disease. Typhus fever occurs among those who live in poor sanitary surroundings in crowded city districts and in those closely confined in ships, jails and the like. Epidemic cerebrospinal meningitis is characterized by the presence of typical meningeal symptoms and has a specific bacteriological ætiology. Purpura hæmorrhagica may be differentiated by its history and the accompanying scorbutic or rheumatic manifestations. The fact that the Widal and the Ehrlich-diazo reactions and bacteriologic examinations are negative will assist in separating mountain from enteric fever.

The prognosis. The severity of the affection is apparently commensurate with the skin eruption (Mayo). In marked types of the infection the skin of the scrotum and thighs becomes much darkened, areas of gangrene make their appearance, and in such instances death usually takes place here as it often does in those patients who exhibit other symptoms of profound toxæmia, such as high temperature, cardiac weakness and cerebral manifestations. In the Bitter Root Valley the disease is particularly fatal, 84 deaths in 121 instances of the affection having been reported. Death usually occurs during the third week, in some instances complications, especially pneumonia, being responsible.

Prevention. The districts in which the disease is common should be avoided during the months in which mountain fever is prevalent. Measures to avoid tick bites should be taken and when these have taken place the insect should be at once removed by the application of kerosene, ammonia or turpentine and the wound cauterized by pure phenol.

Treatment. This is in general symptomatic. The employment of quinine given in large doses hypodermatically has given favorable results in a few instances. The fever may be controlled by the hydrotherapeutic measures indicated in enteric fever; the bowels should be kept open, and elimination by means of the skin and kidneys should be assisted by the usual method

applicable in infectious febrile diseases; the severe pains may be relieved by means of the administration of Dover's powder or small doses of morphine, preferably given by hypodermatic injection.

The patient's strength and nutrition should be maintained by means of easily digestible fluid food; fortunately the digestive tract does not appear to require such careful management as in enteric fever, consequently the feeding is a more simple matter than in this latter disease.

The nursing and general management of the patient should be carried out along the lines suggested in the section on the treatment of enteric fever.

Intermittent Tick Fever. Under this term Kieffer has recently described what he considers to be a form of ixodiasis which has been observed by him in the neighborhood of Fort D. A. Russell, Wyoming. He reports seven instances of the disease, from which he concludes that it appears necessary to produce the infection that the tick should fasten itself to the skin of the patient. It also seems probable that the number of the insects biting the patient has some influence upon the severity of the attack to follow. In all the patients observed there was distinct history of tick bites as well as indubitable evidence of the bite at the place where the insect had fastened itself. At these points, in a number of the patients, small nodules were observed; these persisted for weeks, were firm, pale in color, entirely painless, and varied in size from that of a pea to that of a small marble. In other instances the site of the attachment of the insect was marked by a small red papule in some of which the rostrum of the tick was demonstrable. Specimens of the insect examined by Dr. C. W. Stiles, of the Public Health and Marine-Hospital Service, were proven to be identical with the *dermacentor occidentalis*.

The patients were affected, in general, in a corresponding manner. After a period of incubation varying from three to seven days, during which prodromal symptoms consisting of headache, vague pains, nausea and vomiting are present, the disease is ushered in by a severe chill lasting from two to three hours. It is not characterized by chattering of the teeth and shivering like the chill of malaria, but is associated with more pain and discomfort, and the patient seems to suffer quite as much as in the painful stages of influenza or dengue. The pains affect chiefly the head and the bones and joints. Following or accompanying the chill there is an elevation of temperature which reaches 103° to 104° F. (39.4° to 40° C.). The fever remains high, as a rule, for forty-eight hours, but in some instances persists for but half this period, and is followed by a remission during which the temperature drops to normal or approaches this point. With the remissions the pains disappear and the patient, while he feels weak and exhausted, is otherwise comfortable. The temperature remains normal for about forty-eight hours when the second chill begins and is followed by a febrile movement. This paroxysm terminates in a manner similar to the first. Succeeding paroxysms are usually

milder in degree. Rarely there is a febrile movement lasting one day but here there is an intermission lasting three days.

Other symptoms are abdominal pain and general, but not very marked, tenderness. Tympanites sometimes is observed. The liver is not demonstrably increased in size but there is early moderate enlargement of the spleen and the regions of these organs may be rather more tender than other areas of the abdomen. The urine is usually concentrated and high colored but is in no way typical. No skin eruption has been noted.

The blood showed absolutely no agglutination reaction to the typhoid bacillus and no malarial organisms were found, although the blood of each patient was searched. Careful search was also made for the *pyroplasma hominis* but no bodies were found which could be considered to resemble this organism except a few objects which were considered to be artefacts or evidences of vacuolization in the red blood cells. A progressive diminution in the number of the red cells was constantly present and there was a corresponding diminution in the amount of hæmoglobin. Examination of the leucocytes showed a constant moderate relative increase in the number of the large mononuclear cells; this is the case in malaria and is said to occur also in Rocky Mountain spotted fever.

Treatment. The administration of quinine appears to have no effect upon the disease and seems to increase the discomfort of the patient, but arsenic, given by hypodermatic injection, is believed to control the paroxysms and exert a curative action upon the infection. The arsenic injections may be followed by a burning sensation and to obviate this the addition of cocaine is suggested. Kieffer suggests the following formula: Sodium arsenate 1 part, cocaine hydrochloride 4 parts, water 100 parts. Thorough antiseptic precautions are necessary to prevent abscess formation. The dosage is from 15 to 30 minims (1.0 to 2.0) twice a day. During convalescence the patient's anæmia should be combated by means of arsenic *per os* in connection with iron and other tonics.

TYPHUS FEVER.

Synonyms. Jail, Camp, Ship, Hospital, Putrid or Spotted Fever; Black Death.

Definition. An acute infectious disease characterized by a typical skin eruption, nervous symptoms and a high temperature terminating usually by crisis in about two weeks.

Ætiology. Typhus, while comparatively rare during the past few decades, was formerly one of the world's greatest scourges. Its gradual disappearance is undoubtedly due to the increased attention paid to sanitation and the education of the masses along general hygienic lines.

The disease is of markedly infectious nature but up to the present its specific cause has not been determined. It is most common in young adults but no age is exempt. Its occurrence is favored by crowded and filthy conditions, unhygienic surroundings and mode of life, poor ventilation, and famine. As these factors are becoming year by year less conspicuous features of our civilization there is every reason to hope that the disease will ultimately disappear from the earth.

Isolated cases at times have occurred, but despite this evidence and the fact that Murchison considered the spontaneous origin as possible, it is not to be regarded as a probability in the light of present day knowledge.

While the nature of the contagion is unknown it is recognized that it is of easy acquirement and difficult of destruction. It seems to be transmitted through the atmosphere and to be given off from the patient's body. Consequently it is communicable from one person to another and through furniture, bedding, clothing, etc., to which the poison of the disease clings for long periods. It is said that the contagium cannot pass through the air from hospitals or other structures in which patients suffering from the disease are confined, to dwellings in the vicinity. To acquire the infection intimate and fairly continuous association with the patient seems to be necessary, consequently nurses are much more frequently affected than physicians who are with the sufferer for but a few moments each day, unless indeed, these latter are in attendance upon a typhus hospital or ward.

It has been thought that the contagium is given off from the skin and in the expired air; it may, however, be in all the body excretions and discharges for anything that is certainly known to the contrary.

Pathology. There are no characteristic *post mortem* lesions. The tissues show the changes which always accompany acute febrile disease of severe type. The petechial eruption persists after death, in contradistinction to that of enteric fever, and bed sores may be present; the blood is dark and fluid. The spleen and lymph glands are enlarged and soft, the kidneys and liver may be increased in size. The tissues, including the muscles, and particularly that of the heart, and organs are in a condition of acute degeneration (cloudy swelling). There is no intestinal ulceration; the lungs are frequently the seat of hypostatic congestion and there may be evidences of bronchial inflammation.

Symptoms. The incubation is from 10 to 12 days; the invasion is usually sudden but general malaise may occur before this event takes place. The invasion is marked by one or more chills followed by fever and headache and severe bodily pain, especially in the back. After the initial chill the temperature rises rapidly and reaches its maximum (104° to 106° F.—40° to 41.1° C.) from the fourth to the seventh day. The patient is greatly prostrated, his tongue is coated and soon becomes dry, nausea and vomiting are commonly

present, the eyes are suffused and the expression is apathetic. Bronchitis is frequent. The bowels are usually constipated.

After reaching its maximum at the end of the first week, the fever continues with slight morning remissions for from 12 to 14 days. At the end of this period it usually begins to fall by crisis and may drop to a subnormal level within 24 hours. Death in severe infections may be preceded by a temperature of 108° to 109° F. (42.2° to 42.7° C.).

The pulse is at first rapid and full but soon becomes weak and perhaps dicrotic as the disease progresses; the first sound of the heart may be indistinct and a systolic apical murmur may be present.

The respirations are rapid, their rate often being further increased by

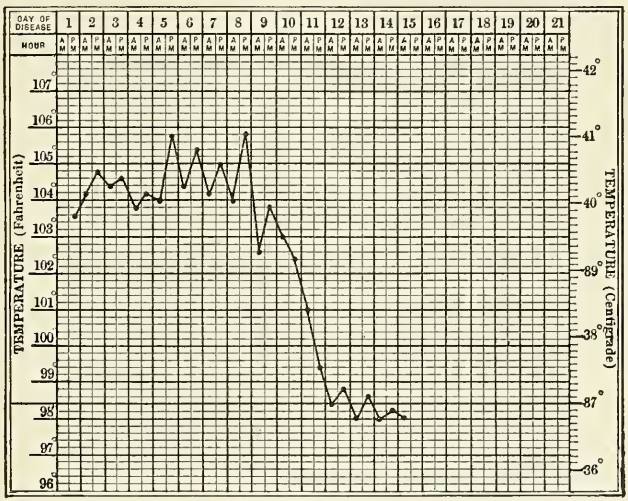

FIG. 2.—Clinical chart of typhus fever ending in recovery.

pulmonary congestion, bronchitis or a co-existent broncho-pneumonia which may be followed by pulmonary gangrene.

The urine is scanty and high colored and frequently contains albumin and casts.

There may be a slight increase in the number of the leucocytes, the opposite of this condition obtaining in enteric fever.

The eruption is constant and appears on the third to the fifth day; its evolution is rapid. It presents itself first upon the chest and abdomen and, quickly spreading to the limbs and face. involves the whole body within two or three days. The rash consists of two elements: a dark mottling of the skin characterized by blotches of light or dark purple; these may be rendered lighter

in color by pressure and at times become the seat of subcutaneous hæmorrhage; and a slightly raised petechial eruption. This is pinkish in color and resembles the rash of enteric fever, disappearing at first on pressure but later persisting; these spots also are hæmorrhagic and, like the mottling, persist *post mortem*. After the eruption, which lasts from 7 to 10 days, has disappeared desquamation usually takes place. Children, in whom the disease is seldom fatal, may show no rash whatever, or the skin may be covered by an eruption not unlike that of measles.

During the second week all the symptoms become more marked. The prostration is severe, and delirium, changing into stupor with subsultus tendinum, nystagmus and even coma vigil, develops. The tongue is cracked and dry, the teeth are covered with sordes, the temperature is persistently high, the pulse rapid, weak and perhaps dicrotic, the respiration is accelerated and the patient may die exhausted by the infection. In the event of his recovery the temperature rapidly falls by crisis and a deep sleep occurs from which the patient awakes greatly improved, the mental and all other symptoms being in a much ameliorated condition. The convalescence now progresses unless a relapse, which rarely takes place, occurs.

Variations in the course of the disease may be observed. Both malignant forms, in which death supervenes within a few days, and mild types with only slight rise in temperature and other insignificant symptoms, have been described.

Complications. Of these broncho-pneumonia is the most frequent. Gangrene of the extremities, paralysis and septic infections, such as subcutaneous abscesses, parotitis and arthritis, may occur. Noma has been observed in children.

The diagnosis in epidemics is easily made but isolated cases may be mistaken for enteric fever, from which typhus fever may be differentiated by its more rapid initial rise in temperature and otherwise more sudden invasion, by its eruption and the absence of Widal reaction. In malignant smallpox the more common occurrence of hæmorrhages is an aid in differentiation. Epidemic cerebrospinal meningitis at its onset may closely resemble typhus fever but after a few days the diagnosis is usually clear, and malignant measles may be differentiated by the accompanying conjunctivitis and coryza and the fact that other cases of measles are in the vicinity. The eruption of measles is of brighter red, presents itself first on the face and is likely to be crescentic in form.

The prognosis varies in different epidemics ranging at times as high as 50 percent., the usual figures are, however, from 12 to 20 percent. In children the disease is seldom fatal.

Treatment. Patients suffering from typhus fever should be strictly isolated, preferably in tents where the free ventilation not only exerts a favor-

able effect upon the patient but renders the physicians and attendants less likely to contract the disease. The fever should be controlled by the hydrotherapeutic measures employed in enteric fever. By these means not only is the temperature lowered but a favorable influence is exerted upon the nervous system. Coal tar antipyretics should not be relied upon although they may be occasionally prescribed in connection with other antipyretic treatment. Their weakening effect upon the heart should never be lost sight of, and if given. these drugs should be administered in connection with stimulants which shall counteract this action. Heart stimulants are indicated early in the disease and of these alcohol in the form of whiskey or brandy is to be preferred; digitalis and strychnine are also useful in this connection. Quinine is strongly recommended. Attacks of cardiac failure should be combated by the hypodermatic administration of æther and camphor and the general treatment of symptoms is practically identical with that indicated in enteric fever. The bowels should be kept freely open from the onset of the disease, it being usual, when seeing the patient for the first time, to prescribe a course of calomel in fractional doses to be followed by a saline laxative. The specific treatment by means of the sulphocarbolates, phenol and other antiseptics is probably useless.

In the treatment of this disease the one fact to be kept in mind is that sufficient stimulation is necessary to counteract the continued tendency to heart weakness. In order to control this symptom the dosage should be regulated in accordance with the patient's condition. In markedly asthenic states the hourly administration of as much as an ounce (30.0) or more of whiskey may be necessary.

The diet should be entirely of fluids during the febrile stage, milk either plain or in the form of punch with egg and brandy, nourishing soups and the like should be frequently given. As convalescence becomes established soft solids and a gradual return to ordinary diet may be allowed. (See diet of enteric fever, pp. 16 and 17.)

When the disease is treated in hospital wards or private dwellings the most thorough ventilation must be insisted upon.

During the course of the disease the excreta and all articles which come into contact with the patient should be disinfected and if possible destroyed. After recovery the patient's room and its contents must be thoroughly fumigated.

MALTA FEVER.

Synonyms. Mediterranean Fever; Neapolitan Fever; Rock Fever; Undulant Fever.

Definition. An acute infectious disease typified by an irregular temperature, profuse sweats, diffuse pains and a tendency to relapse.

Ætiology. This disease prevails at Malta and in other countries whose shores skirt the Mediterranean Sea. While infrequent in other regions, it has been observed in the West and East Indies, in China and the Philippines. One or two instances have made their appearance in England but none has ever originated in the United States. Malta fever attacks young adults most frequently and prevails chiefly in the summer; its occurrence is favored by unsanitary conditions.

The specific cause of this affection is the *micrococcus melitensis*. This organism is found in the spleen in all instances of the disease which have come to autopsy but as yet has not been isolated from the blood. When inoculated into monkeys a similar disease to that occurring in human beings is produced and the micrococcus may be isolated from the tissues of the infected animals. The organism probably enters the body either upon the inspired air or in drinking water; in one instance the infection has taken place through the conjunctiva. It has been shown that the blood of patients suffering from Malta fever causes agglutination of pure cultures of the bacillus.

Pathology. No definitely characteristic lesions are found in patients dying of this disease. It has been stated that the spleen is enlarged and that other typical lesions of enteric fever are present.

Symptoms. The incubation period is from a few days to three or four weeks. The invasion of the disease is gradual, without chill or marked rise in temperature, but is accompanied by malaise, headache, restlessness and anorexia. These symptoms persist from one to three weeks when the temperature falls and remains normal for two or three days, then it rises once more, is accompanied by chills, associated with which is the return of the other symptoms previously mentioned. This relapse lasts a month or six weeks when a second remission takes place. This may last from one to two weeks and is succeeded by a second relapse which is accompanied by more marked symptoms than the first, and in addition, others, such as sweats, joint pains, effusions, constipation, inflammations of the fibrous tissues, and orchitis; following this is a third remission, after which in turn, another relapse appears, characterized by the symptoms of those preceding, with high fever, night sweats and severe pains. The spleen is as a rule enlarged and may be tender.

The characteristic features of this disease consist in the recurrence of rises of temperature lasting from one to three weeks and separated by afebrile intervals lasting a few or more days. The relapses may recur for two or three years but the usual length of the disease is three or four months. The fever, pain and other symptoms, if long continued, must necessarily exert an exhausting effect on the patient which may prove fatal. Cardiac and pulmonary complications may augment the severity of the disease and become factors in its fatal outcome.

Variations in the type of Malta fever occur, a malignant variety, which

may result fatally within one or two weeks and a mild form with few symptoms save an evening rise of temperature, having been described. One attack of the disease is likely to confer immunity, for several years at least.

The differential diagnosis from enteric fever may be made by means of agglutination tests.

The prognosis is usually favorable, the mortality being put at about 2 percent. by most observers.

Treatment. No drug has a specific effect upon this disease. Attempts have been made to elaborate an antitoxin and at least one patient seems to have been successfully treated by this means.

The bowels should be kept open and the kidneys active. Hydrotherapeutic measures, particularly sponging with cool water, should be employed to control the temperature and the symptoms should be relieved by the methods applicable in like conditions, such as those which occur in enteric fever.

Recently it has been suggested that an exclusively milk diet is unnecessary unless the temperature runs above 103° F. (39.5° C.). To patients whose evening temperature does not rise above this point easily digestible solids, such as the cereals, eggs and bread, are allowed in addition to milk and broths. Even fish and meat are permitted if no ill-effects result from the lighter solids.

During convalescence the patient's exhaustion and anæmia should receive tonic treatment, he should keep in the fresh air as much as possible and his emaciation may derive benefit from inunctions of codliver oil and lanolin. A change of climate, when the patient is able to travel, is distinctly indicated.

RELAPSING FEVER.

Synonyms. Famine Fever; Recurrent Typhus; Spirillum Fever; Seven Day Fever.

Definition. A specific acute infectious disease characterized by a febrile movement lasting six or seven days, followed by an afebrile interval of about a week, after which the febrile paroxysm recurs and may be repeated three or four times.

Ætiology. The most favorable conditions for the development of this disease are those of over-crowding, famine and filth, just as is the case with typhus fever. It is common in East India and has prevailed at times in Europe and the United States. It has not been observed, except in isolated instances, in this country, however, since 1869. Age and sex seem to have no influence upon its incidence.

The specific cause of the infection is the spirochæta of Obermeier which was discovered in 1873. This organism is a spiral shaped bacterium in length from three to six times the diameter of a red blood cell. It is found in the blood, but only during the febrile stage; it has never been demonstrated

in the secretions or excretions. The disease has been produced in human beings and monkeys by the injection of blood from a patient during the febrile stage. Formerly it was believed that recurrent fever was transmitted by means of fomites but the more recent studies of Tictin tend to confirm the idea that it may be carried by means of suctorial insects such as bed bugs, since blood taken from one of these insects which had bitten an infected individual has produced the disease when injected into apes.

One attack of the disease does not confer immunity.

Pathology. No typical morbid changes are observed after death from this disease. During the febrile movement, however, the spleen is enlarged, and the viscera are swollen and are the seat of an acute degeneration

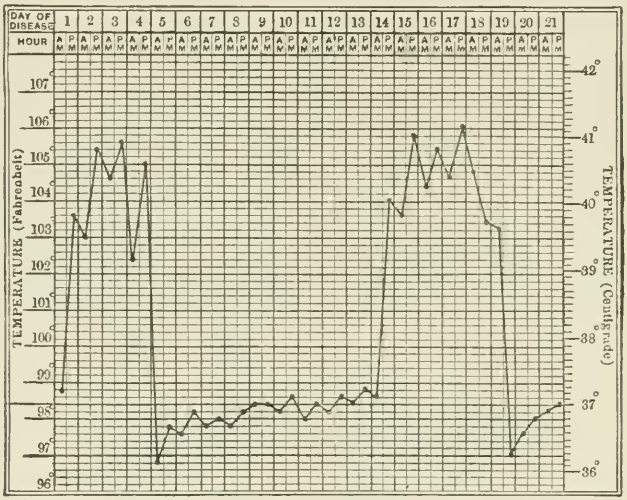

FIG. 3. Clinical chart of relapsing fever.

The skin may be jaundiced and ecchymotic and the bone marrow is in a state of hyperplasia.

Symptoms. The incubation period is usually about one week although the symptoms in certain instances may appear within a day or two after infection. The onset is sudden with a chill followed by fever, malaise and general pains; nausea and vomiting may occur and sweating is common. The temperature rises rapidly and may reach 104° F. (40° C.) upon the first day. In children the disease may be ushered in by a convulsion.

The pulse is rapid (110 to 130). Jaundice is not infrequent and severe nausea and vomiting and cerebral symptoms may be observed. The spleen

is enlarged and, rarely, may rupture. There may be herpetic vesicles upon the lips and petechiæ or mottling of the skin may be noted.

The liver may be palpable. During the paroxysm the blood contains the spirochætæ. The leucocytes are often increased in number.

After the fever has lasted about seven days it falls by crisis in a few hours to normal or below this point and with this fall there is profuse perspiration, sometimes diarrhœa or nose-bleed, and a general amelioration of the symptoms. Within a few hours, or at most a day or two, the patient is apparently well. The crisis may occur as early as the third day or as late as the tenth. In the aged or in weak individuals it may be associated with collapse.

After about one week and usually on the 14th day from the invasion, the paroxysm is repeated, being ushered in by one or more chills, the fever recurs and the other symptoms reappear. The relapse is, as a rule, shorter than the primary paroxysm and is terminated by crisis in the same manner. After another afebrile interval there may be a second, and following this, a third relapse. Rarely has a fourth been observed. Each succeeding relapse is shorter than its predecessor. At times there is no relapse, the patient recovering after the first crisis. Convalescence, while usually rapid, may be much protracted in patients who have been weakened by severe types of the infection.

Complications such as nephritis with hæmaturia, hæmatemesis, rupture and infarct of the spleen, paralyses and obstinate ophthalmia may occur. In females, if pregnant, abortion usually takes place.

The disease is not very fatal; death, however, may take place during the paroxysm in aged and feeble patients or as a result of a complication.

The differential diagnosis from enteric fever and from malaria, the two diseases with which relapsing fever is most likely to be confounded, may be made by examination of the blood. Specimens should be taken from a finger-prick, spread thinly and may be examined fresh or stained with various aniline colors.

Treatment. No drug has yet been found which exerts any influence upon this disease; a serum has, however, been elaborated from the blood of infected horses, the use of which has been attended with good results. The treatment in other respects is symptomatic. The patient should be kept in bed during the paroxysms and should be exposed as little as possible during the intervals, lest a relapse be induced. At the onset a mercurial purge should be given and followed by a saline. Throughout the disease the bowels should be kept open and the kidneys active. The temperature should be controlled by hydrotherapeutic measures and the pains by small doses of the coal tar analgesics. Patients in whom the pain is marked and distressing may be allowed small quantities of powder of ipecac and opium or morphine. In enfeebled patients the early exhibition of stimulants, especially alcohol

and strychnine, is necessary. Emesis may be controlled by pellets of cracked ice, sips of iced champagne, small doses of cocaine or the hypodermatic administration of morphine should this become unavoidable.

The diet during the febrile paroxysm should be entirely of fluids, while during the remissions easily digestible and nourishing solids may be allowed. During the progress of convalescence the patient should receive general tonic treatment.

YELLOW FEVER.

Synonyms. Febris Flava; Bilious Remittent Fever; Typhus Icteroides; Typhus Tropicus.

Definition. Yellow fever is an acute infectious disease characterized by a febrile paroxysm which is followed by a short remission which in turn is succeeded by a relapse. It is often accompanied by jaundice and a tendency to hæmorrhages, especially into the stomach.

Ætiology. This disease prevails endemically in certain tropical cities and, according to Guiteras, these zones of infection may be recognized: *a.* The focal zone, from which yellow fever is never absent, including Vera Cruz, Rio de Janeiro and other Spanish American ports. *b.* The perifocal zone or region of periodic epidemics, which includes the tropical ports of the Atlantic coasts of America and Africa. *c.* The zone of accidental epidemics, between the parallels of 45° north and 35° south latitude.

Yellow fever is seldom seen far from the sea-coast or at an altitude greater than 1000 feet. It is a disease of the summer months, disappearing with the incidence of frost, and is prone to attack cities, especially in their most thickly populated and unsanitary districts. Males seem to be more subject to infection than females, and the disease attacks all ages except young infants. Negroes and mixed races seem to be less prone to the affection than whites, possibly because, during their continued residence in regions where the disease is endemic, they may have suffered from an abortive and unrecognized type of infection. Immunity is usually but not always conferred by one attack.

The specific cause of yellow fever, which is in all probability a micro-organism, has not yet been isolated; several observers have described organisms which they have considered to be the specific germ but their observations have not been confirmed.

The chief, and very probably the only, mode of transmission of yellow fever is through the bite of a species of mosquito, the *stegomyia fasciata*. Rigid experiments have shown that the disease is not conveyed by means of fomites. That the infection may be transmitted to a non-immune by injection of blood drawn from yellow fever patients has also been proven.

Pathology. The skin is of icteroid hue, although jaundice may not have

been evident *ante mortem*, and subcutaneous extravasations of blood may be present. The blood-serum contains hæmoglobin resulting from the destruction of the red blood cells. The heart may be the seat of fatty degeneration. The liver is enlarged and congested, later it undergoes fatty changes and is yellowish-brown in color. Spots of necrosis are usually present. The kidneys are enlarged, congested and the seat of acute inflammation. Areas of necrosis may occur in these organs as well as in the liver. The gastric mucosa is congested and swollen, there may be submucous hæmorrhages and the organ may contain blood-serum and degenerated blood pigment (black vomit). There may be general enlargement of the lymph nodes, particularly those of the peritonæum, of the neck and axillæ. Changes characteristic of yellow fever alone have never been noted.

Symptoms. The incubation period is from three to four days, rarely over five days. Prodromata are rare, the invasion being usually sudden with chilly feelings, or convulsions in the case of children, followed by headache, general pains, prostration and fever. The onset usually takes place between midnight and dawn. The temperature soon reaches 102° to 105° F. (38.9° to 40.5° C.). The face is flushed, the eyes are injected and watery and photophobia is present. The pulse is weak and at first rapid in proportion to the height of the temperature, after a day or two, even though the fever is higher than before, the pulse rate begins to decrease and gradually continues to do so until it may become slower than normal before the fever declines. This lack of proportion between the pulse rate and the height of the temperature is characteristic of this disease and is an important diagnostic point.

The skin is hot and dry, the tongue is red and cracked and the throat and gums may be sore. Slight jaundice may appear early in the disease. Nausea and vomiting may appear at the invasion but are more likely not to occur until the second or third day. In severe infections the vomitus may be of coffee-ground material, tar-like or even of unchanged blood, while in milder forms it consists merely of blood particles, mucus and bile. The bowels are usually constipated but the stools are not clay-colored. With slight variations in temperature this, the first stage of the disease, lasts three or four days and is terminated by the return of the temperature by lysis to normal.

At this time the *second stage* or stage of calm begins, the symptoms disappear and in mild cases convalescence becomes established. In the severe infections this stage, after lasting from a few hours to a day or two, merges into the *third stage.*

In this stage, although rarely there may be no fever, the temperature rises again while the pulse rate may decrease to even as low as 60. The jaundice becomes more pronounced, the tongue is dry, brown and cracked, and nausea and vomiting return. Hæmatemesis with abdominal pain is frequent, there may be tarry stools and hæmorrhages from the nose, gums, uterus, kidneys

and into the skin. There may be suppression of urine with death from uræmia, or the patient may grow progressively weaker and die of the profound toxæmia, the fever remaining elevated until this has occurred. In more favorable instances after a secondary fever of two or three days, the temperature falls by lysis, the symptoms ameliorate and the patient goes on to a protracted convalescence during which jaundice may be persistent.

Albuminuria is a feature of this disease, appearing in mild infections even on

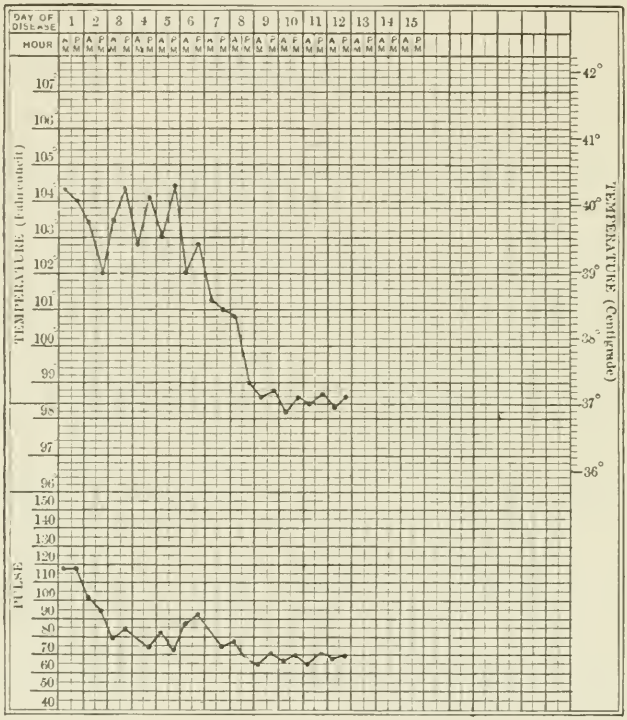

FIG. 4.—Clinical chart of yellow fever showing the pulse typically slow in comparison to the height of the temperature.

the second or third day. It may be merely transitory but in severe infections it is present in large amounts and is accompanied by casts. At times the nephritis may result in anuria and death from uræmic poisoning.

Relapses sometimes take place; complications are not very common; such sequelæ as parotitis and multiple abscesses have been observed.

The diagnosis of the disease may at times be difficult. Malarial fever of the remittent type may be differentiated from yellow fever by the earlier incidence of the remission, the longer duration of the chill and the presence

in the blood of the malarial parasite in the former disease. In the differentiation the three salient characteristics of yellow fever are aids, these being the typical facial expression, slow pulse and early occurrence of albuminuria. These points are serviceable in the separation of the disease from dengue as are also the hæmorrhages and the early occurrence of jaundice in yellow fever in contradistinction to the absence of the former and the possible later incidence of the latter in dengue.

The prognosis in yellow fever is grave, the severer forms of the infection being particularly fatal. In weak, poorly-nourished and alcoholic subjects the chances of recovery are less than in those in whom the opposite conditions obtain. Of patients who exhibit the "black vomit" by no means all die, but those profoundly poisoned and in whom mental and kidney symptoms occur seldom recover.

The prevention of yellow fever consists in the guarding of patients suffering from the disease from the bites of mosquitoes, in the obstruction of ways of ingress of the mosquito to the house, of the destruction of these insects within dwellings and of the employment of means with a view to prevent their propagation. How effectually the disease may be prevented is evidenced by its rarity in Havana, where it formerly prevailed largely, since proper steps have been taken in prophylaxis. Mosquitoes in dwellings may be destroyed by means of sulphur fumigation and may be prevented from entering by means of screens. Patients suffering from the disease should be surrounded by netting. Although the most recent observers believe that yellow fever is not transmitted in any other way than by the mosquito and that disinfection of clothing, bedding and the like is unnecessary, it may be wise to employ the usual disinfection methods of the sick-room and its contents after the patient's recovery.

Preventive inoculation has not been employed with success.

Treatment. The patient should be isolated and screened. He must be strictly confined to bed from the onset and should be moved as little as possible. The bowels and bladder must be evacuated while in the recumbent position and, should it be impossible to urinate under these circumstances, catheterization must be undertaken. All body and bed linen must be kept scrupulously clean and when these are changed the utmost care not to disturb the patient to the least degree must be observed. Food and medicines, when taken by mouth, should be given by means of a spouted cup or through a tube, so that the head need not be raised.

At the onset of the disease the bowels should be opened by fractional doses of calomel followed by a saline laxative; here magnesium, in the form of the effervescing citrate, or sodium sulphate is to be preferred. The kidneys should be mildly stimulated by one of the alkaline diuretics and the skin kept active by means of tepid sponge baths. During the febrile stages it is

wise to feed entirely *per rectum* and to administer medication by means of this channel or hypodermatically. For the temperature and nervous symptoms hydrotherapeutic measures are indicated. Cool sponging is perhaps best and the baths should be given with great care so as to disturb the patient as little as possible. The pain may be relieved by means of small doses —gr. v (0.33)—of acetphenetidine (phenacetine) combined with caffeine sodio-benzoate if there is the slightest tendency to cardiac weakness. While most authorities advise the hypodermatic administration of morphine if the pain is severe, certain observers, whose experience of the treatment of yellow fever has been considerable, consider this drug contraindicated at all stages of the disease; quinine given *per rectum*—gr. xx (1.33)—is useful in this affection. Formerly this drug was extensively employed in yellow fever and while it is probable that it exerts no specific effect its administration does no harm. Vomiting is difficult of control and should be treated by pellets of cracked ice. Small doses of cocaine—gr. $\frac{1}{4}$ (0.016)—of hydrocyanic acid, of creosote or of phenol have been recommended but ice alone usually accomplishes all that is possible. Hæmorrhage may be combated by the hypodermatic administration of ergot or by means of calcium chloride, gr. xl (2.66) *per rectum*. The latter drug is said to cause an increased coagulability of the blood. Lead acetate and iron perchloride have been advocated but are probably better omitted.

During the course of the disease the kidneys and the circulatory system may be stimulated and the toxæmia lessened by high rectal irrigations of hot —110° to 116° F. (43.5° to 46.5° C.)—normal saline solution. Two of these may be given daily and the quantity should be at least 1 gallon (4 litres). The uræmic symptoms respond very favorably to this means of treatment; here also hot baths and packs are useful. If at any time there are symptoms of cardiac weakness, free hypodermatic stimulation by means of alcohol, strychnine, digitalis, camphor and æther, or camphor and oil are indicated. Collapse may be treated by this means, by the hypodermatic or intravenous administration of considerable quantities of normal salt solution and by enemata of strong black coffee.

During the stage of remission the patient's strength must be supported by means of stimulants and tonics.

The following treatment of the disease has been recommended. Sodium bicarbonate gr. vii ss (0.5) and mercury bichloride gr. $\frac{1}{60}$ (0.001) are given dissolved in ice water every one or two hours, depending upon the severity of the infection; the sodium bicarbonate tends to lessen the excessive acidity of the gastric juice and urine and, by rendering the latter alkaline, the tendency to nephritis and anuria may be diminished. At the invasion the patient is given a hot mustard foot bath and for the following three or four days cool sponges are given, an ice bag is applied to the head and a sinapism to the

epigastric and lumbar regions. No food is given during the first three days of the disease.

The serum treatment of yellow fever, although the subject of much experimentation, has as yet yielded no very favorable results.

During convalescence the patient should be kept in bed or at any rate until the profound prostration which is a feature of yellow fever has disappeared and the heart and kidneys have returned to their normal action, he should be kept at rest. Tonics such as iron, strychnine and quinine should be prescribed.

The food during the febrile stages should be administered wholly *per rectum*, nutrient enemata such as those suitable in gastric ulcer being indicated (see p. 366); during the remission fluids may be given by mouth and, after convalescence has become established, the greatest caution must be observed in feeding. No solids should be given for at least ten days after the symptoms have subsided and too large quantities at a time must be avoided. The first foods allowed by mouth are peptonized milk, milk, milk and vichy, kumyss or matzoon, one drachm (4.0) every half hour, later beef juice may be given, then the whites of eggs, the proprietary infant foods, broths and gruels. Gradually the various semi-solids, junket, cereals, milk toast, etc., may be added until finally the patient is able to tolerate solid diet.

INFLUENZA.

Synonyms. Epidemic Catarrhal Fever; Grip.

Definition. An acute infectious disease, generally endemic and from time to time occurring in widespread epidemics, characterized by catarrhal inflammations of the various mucous membranes, prostration and a tendency to involvement of the nervous system.

Ætiology. At various periods of the world's history since the sixteenth century widespread epidemics of this disease have occurred, the last of these in 1889, when within a year it had prevailed in most parts of the civilized world. Since this epidemic, in most American cities, there are seen yearly a number of instances of epidemic influenza. Epidemics remain in a locality from one to two months and the affection is prone to attack a very large proportion of the population. Epidemics differ greatly in severity and in liability to complications.

The specific factor in the causation of this disease is the influenza bacillus which was discovered by Pfeiffer in 1892. It occurs in great numbers in the nasal, tracheal and bronchial secretions of patients affected and may be easily demonstrated.

Epidemic influenza is markedly contagious and rapid in its spread, and occurs with its greatest degree of severity in the colder seasons of the year. Unhy-

gienic surroundings do not seem to affect its incidence; it attacks all ages and both sexes and those who have suffered from one infection seem more prone than others to a second.

Authorities differ as to the portal of entry of the contagium, probably, however, it reaches the organism upon the inspired air and the infection takes place through the respiratory tract. It is also asserted that the primary lodgment of the bacillus may be the gastro-intestinal tract or the conjunctiva.

Pathology. This disease is characterized by no typical lesions; only those due to the complications are found *post mortem*. In the abdominal type of the infection there may be enlargement of the solitary and agminated follicles of the intestine.

Symptoms. The incubation period is from one to three or four days, although, at times, the interval between the entrance of the contagium into the body and the manifestation of the symptoms may be longer.

The onset is usually sudden with a chill followed by a rise in temperature—101° to 104° F. (38.4° to 40° C.)—severe headache and marked bodily pains; nausea and vomiting, together with the other symptoms usual at the beginning of an acute infection, and very pronounced prostration may be present. The fever lasts from two to six days and may be of remittent or intermittent type; in certain instances the elevation of the temperature may be the only symptom and rarely the patient may exhibit a continuously high temperature lasting for several weeks and which closely resembles that of enteric fever; the pulse is rapid and may, in severe types of the disease and in the aged, become feeble. During the course of the disease various skin eruptions, erythematous or even purpuric, may appear and simple pharyngitis may be present. As the temperature approaches the normal at the termination of the disease, sweating may occur and the symptoms gradually subside.

The disease manifests itself in one of several types which are very prone to merge into one another.

a. The catarrhal type is characterized by symptoms referable to the mucous membranes of the respiratory tract and conjunctivæ. At the onset the symptoms of coryza, with sneezing, nasal discharge, a feeling of fulness in the head, sore throat, hoarseness and conjunctival injection, are present. In the milder instances of the disease there may be no further symptoms, but more often there is bronchial inflammation, with cough, at first dry, later with mucopurulent and sometimes very copious expectoration; rarely the sputum is dark and blood-stained. Various pulmonary complications may ensue.

b. The nervous type begins with severe headache, pains in the bones and joints and extreme depression and prostration; rarely there may be convulsions. In some instances there are symptoms resembling those of meningitis, such as photophobia, hypersensitiveness to sounds, pain in the back of the head and stiffness of the neck. Delirium may be present. The nervous symptoms

gradually subside after a few days but during convalescence there is a marked tendency to mental depression and neuralgia in various parts of the body.

c. The gastro-intestinal type is evidenced by nausea and vomiting at the invasion, or abdominal pain, distention and diarrhœa; the symptoms may be so severe as to suggest appendicitis or peritonitis. Jaundice and splenic enlargement may be present.

Complications and sequelæ. Of these one of the most common and serious is pneumonia due to the influenza bacillus alone or to a mixed infection. It is rarely if ever of the lobar form, usually being catarrhal or lobular, and is frequently fatal. Pleurisy is not a common complication but when it occurs is likely to become purulent.

Bronchiectases may occur. Circulatory complications may appear. Pericarditis is rare; less so is endocarditis which may be of malignant type. In a few instances the influenza bacillus has been grown from the vegetations. Myocarditis may occur and functional cardiac disorders, such as palpitation, irregular heart action, bradycardia and tachycardia are frequently met. Sudden cardiac failure may cause death. Thrombosis and phlebitis have been observed.

Peritonitis, cholecystitis and septicæmia are rare sequelæ; nephritis and orchitis have been noted.

Complications referable to the nervous system are not infrequent and among them may be mentioned encephalitis, meningitis—the bacilli having been demonstrated in the fluid withdrawn by lumbar puncture—cerebral abscess, myelitis, neuritis of various types, and paralyses. Mental disorders such as melancholia or even dementia may occur. Optic neuritis and iritis have been described; otitis media and dizziness, due to affection of the labyrinth, are possible consequences.

It is of the utmost importance to keep in mind the fact that an attack of influenza is very prone to render any latent disease active and to increase the intensity of any slight organic affection that may be present.

The diagnosis of influenza during an epidemic is usually easy and may be confirmed when doubtful by the detection of the causative bacillus in the mucous discharges.

The prognosis is usually good. Death may take place from the complications, particularly from pneumonia.

Treatment. The prevention consists in the avoidance of exposure to cold and wet during epidemics and of association with patients suffering from the disease. Isolation of patients should be carried out whenever practicable and the sputum and nasal discharges should be disinfected and destroyed. When influenza is prevalent it is well to practise spraying of the oral and nasal cavities with some mild antiseptic such as liquor antisepticus.

So long as we are ignorant of any specific agent which will abort an attack

or mitigate the severity of the infection we must formulate a treatment for each type of the disease.

In treating the respiratory form of epidemic influenza we should first bear in mind the fact that the prostration, fever and systemic disturbance are out of all proportion to the extent or severity of the disease as evidenced by physical signs; secondly, that, granted a moderate involvement of respiratory area or even a disease stationary so far as extent of tissue is involved, this is no guarantee as to prognosis in an individual case. The logical deduction from this observation is that we are dealing with an infectious process in which prostration is marked and in which supporting treatment is urgently needed. The patient should be kept in bed, while the fever persists, in a room of equable temperature, not too hot, and his diet should be of fluids and as nutritious as possible. The bowels should be opened by means of repeated fractional doses of calomel followed by a saline. If the patient's temperature must, in the physician's opinion, be lowered this may be effectually accomplished by means of the application of an ice water coil placed over the heart or by sponging with cool water. In most instances the fever may be allowed to run its course undisturbed. Antipyretic drugs, for their influence upon this symptom, need not be given. The use of morphine for the pain is likely to interfere with nutrition, dam up the excreta and leave the patient in worse condition than before its employment.

The treatment of the respiratory system consists first in relieving the irritation of the nose and throat by means of a spray of ten drops (0.66) of eucalyptol, 10 grains (0.66) of menthol to an ounce (30.0) of albolene. One of the alkaline antiseptic sprays should be first used in order to dissolve the accumulations of mucus as much as possible and render the mucous membranes clean in order that the full soothing effect of the oily spray may be evidenced.

The bronchitis necessitates the administration of an expectorant which does not disturb the heart. Here we may give ammonium carbonate in doses of from 5 to 10 grains (0.33–0.66) and repeated as frequently as the condition may require, each dose to be given in two ounces (60.0) of milk. The exhibition of this drug will relieve unnecessary coughing, will remove much of the oppression of the chest, will fortify the heart and has the single disadvantage of being prone to disturb the stomach after five or six days.

If the ammonium carbonate is not well borne, strychnine, either as good-sized doses of tincture of nux vomica or strychnine sulphate or nitrate, should be administered. By the strychnine not only is a stimulant effect exerted on the heart muscle and respiratory center, but also an improvement in nutrition due to the drug's action on the spinal cord is brought about. In administering alcohol the previous habits of the patient and the urgency of the symptoms must be considered; usually the patient is better without it.

When the physical signs and clinical symptoms indicate that pneumonia

is present the patient should be bled from the less into the greater circulation by the nitrites—preferably glyceryl nitrate in doses of $\frac{1}{100}$ to $\frac{1}{50}$ of a grain (0.0006 to 0.0012)—and increasing and frequently repeated doses of strychnine must be administered until convalescence takes place. In slowly resolving pneumonias and for an obstinate bronchitis which persists into convalescence, no drug yields better results than creosoté carbonate, 30 or 40 drops (2.0–2.66) given in sherry several times a day.

In order to eliminate the toxins of the disease the skin, bowels and kidneys must be kept active. The pains may be treated by the means described below.

In the gastro-intestinal form of epidemic influenza the pain, nausea and vomiting require relief. At the onset of the infection the bowels should be thoroughly evacuated by calomel given in frequently repeated small doses (gr. $\frac{1}{4}$–0.016). Later intestinal antisepsis may be accomplished by the administration of the organic bismuth salts, the naphtholate, gr. v to x (0.33 to 0.66), the iodophenolphthaleinate, gr. v to x (0.33 to 0.66) or the subgallate, gr. x to xv (0.66 to 1.0). High intestinal irrigations are great aids in the elimination of toxins, not only by the bowels but by the kidneys as well. Frequently rectal alimentation becomes necessary when the stomach is unable to retain even liquid food.

In the nervous type the distressing pain particularly calls for treatment and, while quinine has been much lauded, the author considers that the results obtained hardly warrant its administration to the extent that the severe infection would seem to justify. Euquinine seems to be somewhat more efficient although the statements made that it causes tinnitus are incorrect. Its dose is from 5 to 15 grains (0.33 to 1.0). The giving of the coal tar analgesics has the disadvantage that the drugs of this class that are sufficiently analgesic are also to a greater or less extent cardiac depressants; consequently their unrestricted employment is by no means advisable, and may be even dangerous. It is possible, however, to relieve the pain of influenza, to a considerable extent, without dangerously depressing the heart or respiratory system. This may be accomplished by alternating acetphenetidine, of which the untoward effects are neutralized by combination with caffeine, with acetanilide and methyl salicylate, or with antipyrine salicylate (salipyrine), a combination of antipyrine and salicylic acid. Of this 10 grains (0.66) may be given every 2 or 3 hours until the pain is relieved. Depression may follow the use of this drug in certain instances and it should always be employed with caffeine in consequence. Kryofine may also be used as an analgesic in doses of from 5 to 8 grains (0.33 to 0.52) and may prove more effective and less depressant than most of this series. Gelsemium often will afford great relief from the headache and backache which are common in this disease. It should be pushed until slight ptosis appears, when the limit of its physiological activity has been reached. This drug merits a trial, since

the success, when attained, is brilliant although it is difficult to furnish exact indications for its administration. At times the muscular pains if limited to the back may be mitigated by means of a local application of cataplasma kaolini. This should be spread in sufficient thickness over the painful area, covered with a layer of muslin and kept hot. It is cleanly, retains its heat for some time and is easily renewed. The meningeal symptoms should be controlled by the use of the ice helmet and the application of cold to the back of the neck.

Elimination of the toxins of the disease, as has been previously stated, should be safeguarded. The neutralization of the infectious material in the intestine should be brought about as has been already shown. Diarrhœa, if present, should be considered beneficial. Warm baths relieve the muscular pain and, when accompanied by friction, keep the skin in good condition and add to the comfort of the patient. Not only should the presence of albumin and casts in the urine be determined but the specific gravity, the urea excretion and above all the quantity of urine passed should be carefully noted. For urinary insufficiency no better treatment exists than continuous enteroclysis with decinormal salt solution at a temperature of 110° F. (43.5° C.); this not only aids renal elimination but is a cardiac stimulant of considerable efficacy.

The treatment of influenza in children is practically identical with that of the disease in adults; doses should, however, be regulated in accordance with the age of the patient.

Complications should be treated as when occurring independently.

During convalescence the patient should avoid too early exposure to outdoor air and any possible risk of reinfection. Before going out for the first time the temperature should have been normal for from five days to a week. Nourishing diet and tonics, such as codliver oil, iron, strychnine and the vegetable bitters, should be prescribed.

DENGUE.

Synonyms. Breakbone Fever; Dandy Fever.

Definition. An acute, infectious disease occurring in warm countries, characterized by severe pains in the joints and muscles, fever, and in many instances, by an erythematous eruption.

Ætiology. This disease occurs chiefly in hot climates and during the warmer and more moist seasons of the year; it is common in the East and West Indies but is seldom seen in the United States except along the coast of the Gulf of Mexico. An epidemic occurred in Galveston, Texas, in 1879. One of the affection's distinctive features is its rapidity of diffusion and its proneness during epidemics to attack nearly all persons exposed. While probably due to infection with a micro-organism, the specific cause of the dis-

ease has not yet been definitely isolated. It is probably not transmitted through contact with patients or by means of fomites, the most approved theory of its means of transmission being that certain gnats or mosquitoes may carry the infection from one person to another.

Pathology. Little is known of the *post mortem* changes occurring in this disease, deaths being very rare.

Symptoms. The onset of the disease is sudden, without prodromata, and after an incubation period of from two to five days. The invasion is marked by a chill followed by a rise in temperature, headache, the ordinary symptoms of beginning febrile disease, and severe pains in the muscles, bones and joints. The latter become hot, painful, red, tender and sometimes swollen. It is this joint involvement which gives the affection the name "dandy fever," the gait being so modified that it is supposed to simulate that of a dandy. The rise in temperature is rapid, its maximum being from 103° F. to 106° or 107° F. (39.5° to 41° or 41.5° C.). In two or three days, usually in two, the fever falls rapidly by crisis, with diaphoresis, diarrhœa, diuresis and epistaxis. With the initial rise in temperature an erythematous rash appears which disappears synchronously with the fever. With the fall in temperature the patient feels much improved although weak; the pains are diminished but to some extent persist. After an afebrile period of from two to four days the temperature rises again with a return of the severe pains. The temperature is usually less high than in the preceding paroxysm but the pains may be more marked. With the fever a roseolous eruption appears, first upon the backs and palms of the hands and spreads thence over the entire body. The macules are dark red, circular and about the size of a pea; they may be elevated and are likely to be particularly in evidence about the joints. The spots may coalesce. As the eruption fades, which takes place first upon the hands and arms, then upon the body and finally upon the legs, there is a fine desquamation. The entire duration of the disease is about seven or eight days; at the end of this time the rash has usually faded and rapid convalescence ensues. In certain instances, however, this may be protracted and the patient meanwhile suffers from vague pains in the joints and feet and mental and bodily weakness.

Lymph gland enlargement may be observed and the eruption may persist for several weeks after apparent recovery has taken place. Delirium sometimes accompanies the fever and muscular atrophy has been noted consequent upon an attack.

Complications are rare but relapses are not infrequent.

In epidemics **the diagnosis** of the disease is not difficult, isolated instances, however, may be confounded with acute articular rheumatism.

Dengue is almost never fatal in patients of moderate power of resistance. Death may occur as a result of other infections such as pneumonia, to which

the patient is predisposed on account of the weakening effect of the primary disease.

Treatment. Isolation, in the light of our present knowledge of the probable mode of transmission of the disease, need not be insisted upon, but the access of mosquitoes to the patient should be prevented. Disinfection, also, would seem to be unnecessary.

Absolute rest in bed is an essential until the termination of the second febrile stage. At the onset the bowels should be opened by means of fractional doses of calomel followed by a saline, and throughout the disease the emunctories should be kept active by the means suggested under the section upon the treatment of influenza. The fever seldom needs special treatment on account of its short duration but in instances of hyperpyrexia (105° to 107° F.—40.5° to 41.5° C.) cool sponging or one or two tub baths may be employed. These should be given according to the methods set down for use in enteric fever.

The pains may be controlled by the employment of the means indicated in those of influenza; the salicylates and aspirin, 15 to 20 grains (1.0 to 1.33) every two or three hours until the desired effect has been produced, are also useful in the management of this symptom.

Tincture of gelsemium is said to relieve the pain and to lessen the cardiac excitability; 8 drops (0.52) may be given every three or four hours until the pain is relieved or until the depression of the pulse rate and the incidence of ptosis indicates that the physiological limit has been reached. Opium is seldom necessary for the pain. Excessive nervous symptoms may be controlled by means of the bromides. In a word the treatment of this disease is entirely symptomatic, no specific having yet been discovered.

The diet during the fever should be wholly fluid. During convalescence tonics should be prescribed and strength-giving foods given in digestible form.

MALARIAL FEVERS.

Synonyms. Chills and Fever; Fever and Ague; Paludism; Paludal Fever; Swamp Fever.

Definition. Malarial fever is an infectious disease occurring in several types: *a.* intermittent, in which the febrile paroxysm is quotidian, tertian or quartan; *b.* continuous with remissions; *c.* pernicious; *d.* chronic malarial cachexia.

Ætiology. This disease is less common in the very young and in aged persons than in young and middle-aged adults; it occurs more frequently in the white than in the negro race and is most prevalent in low lands especially in damp and swampy districts along the sea coast. It is more frequently

observed in the tropics and the warmer portions of the temperate zones. In the latter the affection is rare in the spring, most of the instances occurriing in the late summer and autumn. In the tropics it is most common in the months corresponding to the spring and fall.

The specific cause of the malarial infections is a micro-organism, the *hæmocytozoön*, *hæmatozoön* or *plasmodium malariæ*. The *hæmatozoön malariæ* is a parasitic body developing within organism of all the varieties of *anopheles*—the common mosquito—and is transmitted to man through the sting of this insect. The parasite circulates in the blood of man, the intermediate host, and occurs in three forms, each causing a definite and different type of malaria.

The hæmatozoön of *tertian fever*, when seen soon after a chill, is a small, hyaline body, rounded or irregular in shape, and is found within the substance of a red blood cell. Its life cycle is of about 48 hours duration, and consists of the following process: It first increases in size, exhibits amœboid movement and fine granules of pigment develop within it, while the red blood cell becomes larger and paler in color. The pigment gradually assembles itself at the center of the organism and in about 48 hours segmentation takes place. This process consists of the division of the original body which now fills nearly the whole of the red cell into 15 or 20 spores, resembling the original hyaline body. These are set free in the blood, each in its turn, to prey upon a red blood corpuscle. At this time the chill is manifested. Other fully developed organisms may not undergo segmentation. These are larger than those which sporulate and contain pigment granules in active movement. These are a sexually different type of the parasite. In the quotidian type of the infection there are two sets of tertian or three sets of quartan organisms in the blood which sporulate upon different days causing a chill every 24 hours.

The *quartan* variety of the hæmatozoön in its earliest form closely resembles the tertian type but, as it develops, the amœboid movement is more sluggish and the grains of pigment are coarser and their movement is less active. It increases gradually in size, the pigment is seen at its periphery and on the third day its division into radially arranged segments, 6 to 12 in number, is noted. After a 72 hour interval of development sporulation takes place. Here, as in the tertian type, fully developed bodies may be observed which do not break up. These also represent a sexually different form, the gametocytes.

The *æstivo-autumnal* organism is smaller than the preceding forms and contains less pigment. Its full size may be less than half that of a red blood cell. Early in the disease only small hyaline bodies containing, it may be, a grain or two of pigment are to be found in the peripheral circulation. The more mature forms are usually found in the blood of the viscera, particularly

that of the spleen, and the bone-marrow, and the corpuscles containing them may be distorted or crenated and are of brassy color.

The characteristic forms of the æstivo-autumnal type of the parasite, which are crescent-shaped, ovoid or spherical, are seldom seen until the infection has been present for a week or more. These contain near their centers groups of coarsely granular pigment. The crescentic and ovoid bodies do not sporulate and represent the gametocytes. The sexual forms of each type of the organism, entering the stomach of the mosquito, when an infected individual is bitten, are fertilized there and after developing, the spores which result may be transmitted through the insect's bite to a human host and then undergo a further cycle of development.

Pathology. In acute infections there is a diminution of the number of red cells and hæmoglobin in the blood as a result of the disintegration of the former due to the development of the organism. The spleen is enlarged and may rupture, especially if subjected to traumatism. The parasites are present in the blood.

In pernicious malaria there is marked anæmia, the red cells are distorted and degenerated and contain the parasites within their substance. These are also found in the marrow, and this structure and the spleen may be pigmented and the seat of a marked phagocytosis. The spleen may be only moderately enlarged and is usually dark in color and soft in consistency if the disease is the result of a recent infection. The liver is the seat of acute degeneration (cloudy swelling). If cerebral symptoms are marked the brain is congested and the blood in its capillaries contains numerous hæmatozoa; with severe intestinal symptoms the parasites may be numerous in the capillaries of the intestinal tract.

In malarial cachexia the anæmia is pronounced, the spleen is much enlarged, weighing at times 8 or 10 pounds, its capsule is thickened, it is slate colored on section and contains pigment. Its connective tissue framework is in a state of hyperplasia. A like condition obtains in the liver. Melanin may be deposited in the connective tissue beneath hepatic capsule. The kidneys may be swollen, contain pigment and, in some instances, may be the seat of an acute or chronic nephritis. The peritonæum and the gastro-intestinal mucous membrane may be slate color due to the deposition of pigment.

Symptoms. The symptoms of the paroxysms of quotidian, tertian or quartan malaria are practically identical in their clinical manifestation; they occur, however, at different intervals depending upon the time of sporulation of the causative organism. In tertian infection the chill occurs every other day, in quotidian, daily, and in quartan, every 72 hours.

The incubation period of malaria is variable; it may be as short as one day or as long as several months; the average being from one to two weeks, probably depending upon the amount of infectious matter in the system.

The paroxysm may be preceded by prodromal symptoms such as indefinite malaise, yawning, headache or nausea. Prodromata may be wholly absent. The paroxysm consists of three stages, the chill, the fever and the sweat. *The chill* lasts from ½ to 2 hours; it usually occurs late in the morning and almost never at night. Its onset is usually gradual beginning with chilly feelings of increasing intensity until the body shivers with cold and the teeth chatter. Hot water bottles and numerous blankets will not keep the patient comfortable; the face is pinched and pale; the lips are blue, and the patient is apparently very cold yet, at the same time, the body temperature is elevated even to 105° or 106° F. (40.5°–41.1.° C.). There is severe frontal headache and nausea and vomiting may be present. The pulse is rapid, tense and small. The urine is pale, increased in amount and of low specific gravity but before this stage it may have been dark colored and

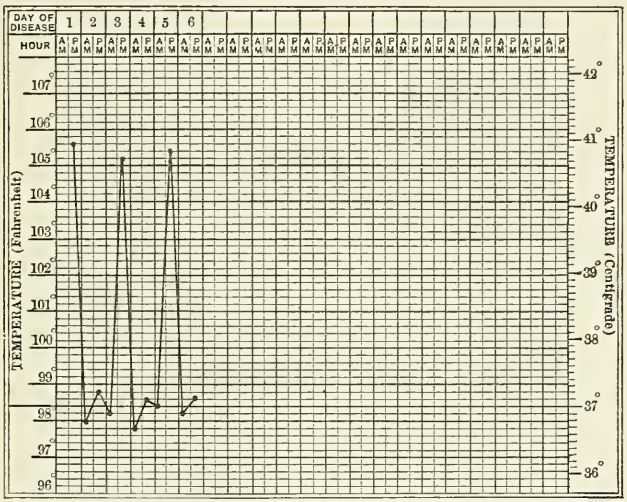

FIG. 5.—Clinical chart of tertian malarial fever.

heavy. At the end of the stage of chill the *febrile stage* begins. This is characterized by flushing of the face, a hot and dry skin, coated tongue, great thirst, severe headache and pain in the back and limbs; the pulse is full, bounding and rapid and active delirium may be present. The temperature may be but little higher than during the cold stage and at times the maximum may be reached at the termination of the chill. The stage of fever lasts from 30 minutes to four or five hours, and is, at the end of this time, followed by the *stage of sweating*. All the symptoms now subside and there is profuse perspiration beginning on the face and gradually involving the skin of the whole body and the patient falls asleep to awake later feeling

perfectly well. This stage lasts ½ to 2 or 3 hours. The sweating may at times be very slight.

The duration of the whole paroxysm is from 8 to 12 hours, but may be shorter. Splenic enlargement may appear and disappear synchronously with the paroxysm but in long continued infections this organ usually becomes permanently increased in size.

The intervals between the paroxysms differ with the type of the infection. Thus in simple tertian fever (infection with one set of tertian organisms) the chill recurs at 48 hour intervals. If two sets of this organism, sporulating on alternate days, are present the paroxysm appears every 24 hours. When a single set of quartan organisms is present the seizure takes place every 72 hours, if two groups, maturing on different days, are present, the patient will have two paroxysms on successive days, then a day free from chill occurs and the round is then successively repeated. If three sets of quartan parasites are present a chill will occur daily. The chills may appear at nearly the same hour upon different days or they may anticipate—that is each will occur an hour or so earlier than its predecessor; also the seizures may be retarded, appearing successively at a later hour.

Without treatment the paroxysms may cease after several have occurred or they may disappear after two or three weeks. In these events they are, however, very likely to recur. If the disease continues the chronic form of malaria, followed by cachexia (q.v.) supervenes.

Æstivo-autumnal malaria, after a period of incubation similar to that of the foregoing types, usually begins with a chill which is more frequently preceded by prodromata than is that of the intermittent types of the disease. There are malaise, general pains and nausea, often with vomiting of bile. The chill may not be well marked and is followed by a regularly intermittent fever; the intermissions are longer than those of the tertian type, or the paroxysms may be anticipated or retarded, rendering the fever continuous with exacerbations. This form of remittent fever markedly resembles enteric fever; the patient appears prostrated, the pulse is rapid and full and the temperature rises, with daily remissions, to 102° to 104° F. (38.9°–40° C.); initial bronchitis may be present, jaundice may be observed and there is acute splenic enlargement. Nervous symptoms may be noted. The infection varies in severity; it may ameliorate after from 7 to 10 days; there may be irregular remissions and exacerbations. In the severe forms the infection may become of the pernicious type. Here the resemblance to enteric fever is especially marked. The tongue is thickly coated, the facies closely resembles that of enteric fever, and the fact that the two affections frequently occur in the autumn renders the differential diagnosis particularly difficult. Blood examination and the test of quinine treatment are aids in the distinction between the two infections.

Pernicious malarial fever is a result of infection with the hæmatozoön of æstivo-autumnal malaria and occurs in three forms.

a. The comatose form may or may not begin with a chill but in its severest type this manifestation is usually well-marked (the congestive chill) and accompanying it delirium, or more often, coma, is rapidly developed. The skin is hot and dry and the temperature ranges from 104° to 106° F. (40° to 41.1° C.). The course lasts from 12 to 24 hours and may be followed by a second attack. The coma is a result of the accumulation of the parasites in the vessels of the brain and may prove fatal.

b. The algid or asthenic form is characterized at its onset by marked prostration and vomiting; collapse may follow and, though the patient may complain of chilly sensations, no real chill may be present. The surface is cold and the temperature normal or subnormal. The pulse is small, rapid and feeble and the respiration shallow. Marked choleraic diarrhœa and urine diminished, sometimes to suppression, may be noted.

These symptoms may continue, slight rises of temperature occurring from time to time, for a few days, at the end of which time death may occur from prostration and the severity of the infection.

c. The hæmorrhagic form. This type includes black-water fever and malarial hæmoglobinuria. It is the result of the malarial toxin although it has been attributed to the use of large doses of quinine; the administration of this drug may, however, aggravate the hæmoglobinuria. Black-water fever occurs in the Southern states, in Central America, in Italy and in Africa.

The condition is met most often in patients who have had frequent attacks of malaria and whose condition approaches that of the cachectic form of the disease. The hæmoglobinuria is usually not accompanied by active malarial symptoms although, preceding its appearance, a febrile movement may have been present for a few days. The cause of the hæmoglobinuria is certainly malaria but whether this manifestation is the result of infection by a distinct type of parasite is unknown. The exciting cause of the paroxysm has also never been ascertained.

Malarial cachexia may result from long-continued exposure to and repeated attacks of any of the types of this disease. Its most prominent symptoms are anæmia and splenic enlargement (ague-cake). The anæmia is characterized by a sallow skin, with sometimes an added subicteroid tinge, coated tongue, disordered digestion and constipation, palpitation and dyspnœa, œdema and coldness of the extremities. The temperature may be subnormal with irregular ascents to 102° to 103° F. (38.9° to 39.5° C.). Hæmorrhages into the retina, from the stomach and other structures may be observed. The examination of the blood reveals the presence of a typical secondary anæmia and, it may be, the presence of malarial organisms, usually crescentic in form.

The edge of the spleen may extend as low as the crest of the ilium and the consistence of the organ is hard and firm.

Complications referable to the nervous system, such as paraplegia, resulting from a peripheral neuritis or deranged circulation in the cord, hemiplegia, acute ataxia and symptoms suggestive of disseminated sclerosis, may occur. Areas of cutaneous gangrene and testicular inflammation have been noted.

The diagnosis of malarial fever is in most cases easily verified by means of examination of the blood, although special training is necessary in order to become expert in the detection of the more unusual forms of the parasite. Further aids in differential diagnosis are absence of Widal reaction and of leucocytosis and the test of treatment by quinine.

The prognosis in simple intermittent fever is favorable. Under proper treatment it is easily curable and in certain instances spontaneous recovery takes place. Continued exposure or insufficient treatment may result in chronic malaria. The æstivo-autumnal type can usually be controlled by proper treatment but may merge into either the pernicious or the chronic type. Pernicious malaria may result in death but recovery from malarial cachexia is the rule.

Treatment. The prevention of this disease consists in the employment of means to exterminate mosquitoes, of screens to prevent ingress of infective insects to dwellings, and in treatment of patients suffering from the disease as well as protecting them from possible mosquito bites, lest the infection be thus transmitted. In malarial regions all exposure to infection, especially after nightfall, is to be avoided. Prophylactic doses of quinine—two to three grains (0.13 to 0.20) three times a day—should be taken by individuals coming to malarial districts.

During the chill, endeavors should be made by means of blankets and hot-water bottles and the administration of hot drinks to keep the patient warm. The headache may be relieved by hot or cold applications. Sponging with cold water may be practised during the febrile stage and the thirst may be mitigated by frequent drinks of cold water or lemonade. During the stage of sweating the patient may be made more comfortable by wiping his skin with hot flannel.

The treatment of intermittent fever consists primarily in the administration of quinine. This drug being absorbed into the blood exerts there a directly poisonous influence upon the parasites present in the same medium. The latter are most susceptible to the effect of the quinine when free in the blood stream, that is, at the termination of the process of sporulation, consequently the drug should be so administered that it shall have been absorbed in time to be present while segmentation is taking place. In order that quinine shall be quickly and in sufficient quantity absorbed, measures should always be taken to render the gastro-intestinal tract—if the drug is to be given by mouth

—as active as possible in performing this function, consequently it is wise to clear the intestine, before the administration of the quinine, by means of fractional doses of calomel to be followed by a saline. Then, in order that the blood shall be impregnated with the drug for an hour or thereabouts before sporulation takes place, it should, when given by mouth, be administered four to six hours before the expected paroxysm. The quantity necessary varies with the severity of the infection and the absorptive power of the gastro-intestinal tract. In the less severe types of the disease 15 to 20 grains (1.0 to 1.33) are often sufficient while in other instances three or four times this amount may be necessary. For several days following, the patient should receive 10 grains (0.66) or more of quinine three times a day, when the dosage may be reduced to five grains (0.33) three times a day. On the seventh day following the last paroxysm an amount commensurate to that administered at the beginning of the treatment should be given and this procedure should be continued every seventh day for about two months. During the first two or three days of the treatment the action of the quinine will be enhanced by confining the patient to bed. After this time he may be allowed up.

The drug may be given in solution, in pill form or in capsules. The solution has the disadvantage of an extremely bitter taste and the advantage of being most readily absorbed. Freshly-made pills or soft gelatin capsules containing the powdered drug are also to be recommended, particularly if their administration is followed by five to eight drops (0.33 to 0.5) of dilute hydrochloric acid to facilitate dissolution. Compressed tablets and stale pills of quinine are very likely to pass through the body undissolved. To patients who cannot take the drug by mouth it may be given hypodermatically in the form of the dehydrochloride or of quinine and urea hydrochloride. Either of these may be taken in doses of 10 to 20 grains (0.66 to 1.33) every two or three hours.

The following formulæ are useful: ℞. Quininæ sulphatis, gr. xv (1.0); acidi tartarici, gr. vii ss (0.5); aquæ destillatæ, ♏ cl (10.0). ℞. Quininæ hydrochloridi, gr. lxxv (5.0); aquæ destillatæ, ℥ii ss (10.0). ℞. Quininæ hdyrobromidi, gr. xxx (2.0); aquæ destillatæ, ♏ xc (6.0).

Quinine hydrobromide may also be given subcutaneously. The drug may likewise be administered in enemata or suppositories, the rectal dosage being at least twice that appropriate by mouth.

Substitutes for quinine spring up from time to time and of these quinidine sulphate and cinchonine sulphate, especially the latter, may be mentioned. The doses of these are about $\frac{1}{3}$ greater than that of quinine sulphate. If in long-continued infections quinine fails to exert its usual influence arsenic may be substituted. It may be given in the form of the liquor potassii arsenitis beginning with doses of five drops (0.33) three times a day or as arsenic trioxide, beginning dose $\frac{1}{20}$ of a grain (0.003) three times a day. These

doses should be gradually increased until the physiological effect is evidenced by œdema under the eyes or by gastro-intestinal disturbance.

Methylthionine hydrochloride sometimes succeeds when quinine is not well borne or is contraindicated, as in pregnancy or hæmoglobinuria. Its action is supposed to be exerted upon the parasite in the blood, just as is that of the latter drug. It should be given in capsules containing two to three grains (0.13 to 0.20) each, of which three per day may be taken. The patient should always be warned that the urine becomes blue while this drug is administered.

Æstivo-autumnal fever should be treated along lines identical with those described above. The patient is, however, much more ill and needs careful nursing. In the forms resembling enteric fever he should be kept in bed and receive fluid diet and stimulants, especially strychnine, as indicated. If vomiting is a feature of the infection it is likely to interfere with the administration of quinine by mouth, consequently hypodermatic injections, as described above, may become necessary. Enemata of quinine dissolved in starch water are also useful. The vomiting should be treated symptomatically, the bowels kept active and the hepatic torpor combated by means of calomel. Rectal feeding may be necessary.

Pernicious malarial fever demands the most active and energetic treatment. The patient should be kept in bed and thoroughtly cinchonized as quickly as possible by means of hypodermatic injections of large doses. An even more rapid method is that by intravenous injection of the drug.

The following solution may be employed: ℞. Quininæ hydrochloridi, gr. xv (1.0); sodii chloridi, gr. i (0.65); aquæ destillatæ, ℥ii ss (10.0).

The cerebral symptoms may be relieved by the bromides or by opium, if necessary, and stimulation by means of strychnine or alcohol may be indicated. The bowels should be kept open; the chills may be relieved by external warmth and the excessive fever by cool sponging.

In giving hypodermatic injections of quinine a long needle inserted deeply into the muscular tissues of the back or buttocks, should be used. Abscesses are very prone to follow and in order that they may be prevented, in so far as may be possible, the strictest aseptic technique should be employed.

Malarial Cachexia. Here quinine is also indicated although not necessarily in large doses, Warburg's tincture containing 10 grains (0.66) of quinine to the ounce, often acts well in doses of ½ an ounce (15.0) three times a day. Cinchonidine sulphate in doses of 10 to 15 grains (0.66 to 1.0) three times a day is also useful. It is in this form of malarial infection that arsenic is particularly indicated, it may be given alone in the form of liquor potassii arsenitis or in combination with iron and quinine. The following formulæ are suggested: Quinine in pill form with ℞. Ferri et potassii tartratis, ℥ss (15.0); arseni trioxidi, gr. i (0.065); aquæ destillatæ q. s. ad ℥iv (120.c). Misce et signa, one teaspoonful after each meal; or ℞. Arseni trioxidi, gr. $\frac{1}{20}$

(0.003); massæ ferri carbonatis, gr. v (0.33). Misce. Signa. Take one such pill after each meal.

Arsenic may also be given hypodermatically as follows: ℞. Sodii arsenatis, gr. $\frac{1}{10}$ (0.006); aquæ destillatæ q. s.; or, ℞ sodii arsenatis, gr. $\frac{1}{10}$ (0.006); sodii phosphatis, gr. $\frac{1}{20}$ (0.003); sodii sulphatis, gr. $\frac{1}{10}$ (0.006); aquæ destillatæ q. s.; or, ℞ ferri et ammonii citratis, gr. i ss (0.1); sodii arsenatis, gr. $\frac{1}{10}$ (0.006); strychninæ sulphatis, gr. $\frac{1}{30}$ (0.002); aquæ destillatæ q. s.

Of these one injection may be given daily. Sodium cacodylate, $\frac{1}{2}$ to $2\frac{1}{2}$ grains (0.03 to 0.15) daily, may prove useful. In treating this form of malaria, either with or without iron, the bowels should be kept regular; a course of fractional doses of calomel may be indicated from time to time in order to keep the liver active and at intervals mild laxative pills may be employed.

The treatment, otherwise than that discussed above, consists in the employment of all measures, dietetic, hygienic and hydrotherapeutic, to improve the patient's general condition, and, removal to a different climate, a mountainous district if possible.

The Treatment of Malarial Hæmaturia. Here, unless active parasites are present in the blood, it is wise to omit quinine but should they be found this drug is strongly indicated. In the milder forms five grains (0.33) three times a day will cause this symptom to cease. Even when no plasmodia are present certain writers advocate small doses of quinine beginning with one grain (0.065) and watching the effect on the hæmoglobinuria. Methylthionine hydrochloride, gr. ii to iii (0.13 to 0.2) three times a day, may be given as also may sodium hyposulphite in doses of 20 grains to 1 drachm (1.33 to 4.0) three or four times a day. Otherwise the treatment of hæmoglobinuria is symptomatic. The organs of elimination, the skin, kidneys and bowels, should be kept active by means of diaphoretics such as pilocarpine $\frac{1}{8}$ to $\frac{1}{6}$ of a grain (0.008 to 0.011) given hypodermatically and with caution, and by hot packs, by high rectal irrigations of hot saline, hypodermoclysis or intravenous infusion. Stimulant diuretics are to be avoided; cardiac stimulation by means of strychnine and the diffusible stimulants is often necessary.

NASHA FEVER.

Synonyms. Nasa Fever; Nakra Fever.

Definition. An acute infectious febrile disease characterized by nasal congestion and localized swelling of the septum nasi.

Ætiology. This affection occurs in certain districts of India. Adults are most commonly affected, the disease being rare in children and old persons. It is observed chiefly in summer and is predisposed to by lack of proper nourishment, unhealthy mode of life and unsanitary conditions. Its specific cause is not known although it has been considered a form of malarial infec-

tion. The facts that quinine does not influence its course and that the hæmatozoön of malaria is not constantly found are not in accordance with this theory of its causation.

Symptoms. The characteristic manifestations of this disease are hyperæmia of the nasal mucous membrane and swelling of the septum in particular. It is ushered in by malaise, prostration, and general pains in the head, body and limbs. The fever is seldom high and there may be a general eruption of small rose-red spots. The febrile movement persists for from three to five days when the temperature gradually falls and the other symptoms subside. A fatal issue, preceded by sudden amelioration of the nasal manifestations and by coma, has been observed in rare instances. Immunity is not conferred by an attack.

Treatment consists in employment of the means indicated to control like symptoms occurring in other infectious fevers.

Puncture of the septal tumor is said to be followed by an amelioration of all the symptoms.

CHOLERA.

Synonyms. Cholera Asiatica; Cholera Algida; Epidemic Cholera; Cholera Maligna.

Definition. An acute infectious disease caused by a specific micro-organism and characterized by emesis, violent purging, abdominal cramps and collapse.

Ætiology. This disease for many years has been endemic in India and from time to time becomes epidemic. Epidemics have also occurred in other parts of Asia, in Egypt and in Europe, whence it was first brought to America in 1832. Since that time the disease has visited this country at intervals, the last time being in 1892 at the time of a general Asiatic and European epidemic, when a few instances were reported in New York City.

The disease is met in all ages and both sexes, but children and old persons seem most prone to acquire the infection. Cholera occurs more frequently in low lying districts near the sea coast than in higher inland regions, it is more common in warm countries and prevails during the summer months in the temperate zones. The contagium is usually killed by the incidence of frost. The infection is predisposed to by over-population, unsanitary surroundings, bad personal hygiene, intemperance and any influence which tends to reduce the resisting power of the human body.

The specific cause of Asiatic cholera is the comma bacillus of Koch which was discovered in 1884. It is found in the intestines of all persons suffering from the disease, is usually accompanied by the colon bacillus and often by the streptococcus. It is given off from the body in the dejecta. Rarely is

it found in the vomitus. The disease is the result of the growth and propagation of the bacillus in the body.

Mode of Infection. The bacillus of cholera is taken into the gastro-intestinal tract in drinking water or upon food. The disease is not contracted by association with patients although by handling the patient's discharges the hands may become contaminated and in this way the contagium may be transferred to the mouth. Vessels washed in contaminated water, vegetables washed or watered with water containing the spirillum, or food upon which flies, which have previously come in contact with infectious matter, have alighted, may transmit the disease. The spirilla are quickly killed by drying, consequently it is hardly probable that they may be taken into the system upon the inspired air; they are capable, however, of living upon bread, meat and other foodstuffs for from six to eight days. The severity of the infection depends upon the amount of the contagious matter taken into the system and upon the resistance of the individual. It is known that the gastric juice is decidedly inimical to the spirillum and individual immunity has been observed, virulent cultures having been isolated from the stools of healthy persons.

In direct opposition to Koch's theory of the propagation of cholera is that of Pettenkoffer who holds that the micro-organism of the disease develops in the soil-water of the East during the warm months and rises thence as a miasm into the air. He asserts that conditions favoring its development are a low-ground water, associated with porosity, moisture and organic contamination, particularly sewage.

It is not certain that one attack of the disease confers immunity.

Pathology. On gross inspection the body is usually much emaciated, the skin over the non-dependent parts is grayish in color while that over the dependent portions of the body is livid or mottled.

Post mortem rise in temperature may occur and, while *rigor mortis* is an early manifestation, contractions of the muscles of the jaws, the eyes, or of the limbs may be observed. The subcutaneous tissue when cut is dry, owing to the fact that the body liquids have been drained away, and the blood is thick and dark. The peritonæum is viscid, the intestines are congested but not distended. The stomach may contain a turbid liquid resembling rice-water; its mucous membrane is congested and its vessels are distended, the epithelium may be eroded or intact. The lining of the small intestine is usually congested and the cavity of the bowel contains turbid serum (rice-water material); in the later stages the hyperæmia is more apparent and the solitary and agminated follicles may be swollen; rarely they may be ulcerated. Ecchymoses and denudation of the mucous membrane may be observed, the latter probably having taken place after death. Patches of false membrane may be found in the intestine in infections of prolonged course. The comma bacillus is found in the contents of the bowel and in its mucous membrane.

A condition of acute parenchymatous degeneration (cloudy swelling) obtains in the liver and kidneys, the former may also show areas of fatty degeneration and the latter coagulation necrosis with desquamation of the epithelial lining of the uriniferous tubules. The spleen is not enlarged and may be decreased in size.

The heart is dry and flaccid. The left auricle and ventricle are empty while the right are filled with dark liquid blood. The lungs may be shrunken and bloodless, except at the bases posteriorly, where they are likely to be the seat of passive congestion.

Symptoms. The incubation period is from two to five days after which the invasion of the disease occurs. The symptoms may be grouped in three stages which are more or less distinct.

a. The stage of preliminary diarrhœa. This stage may be sudden in its onset or preceded by abdominal pain, malaise, headache and emesis. The diarrhœa is painless, the stools are frequent, fluid, yellowish or of "rice-water" type and are alkaline. They contain the comma bacillus and other micro-organisms; there is usually no rise in temperature. This stage lasts from a few hours to a week or more or may be absent.

b. The stage of collapse is characterized by a profuse "rice-water" diarrhœa, the movements being very frequent, and apparently forcibly expelled. Paroxysmal pain and tenesmus may be present but the patient is more often distressed with painful muscular cramps in the limbs and abdominal wall. Thirst is marked and emesis is profuse, fluid resembling the stools being vomited incessantly and in great quantity. The patient rapidly becomes exhausted, and often sinks into a condition of collapse with sunken eyes, shrunken features, pallid face, cold and clammy extremities. The surface temperature may sink 4° or 5° F. (2° to 2.5° C.) below normal while the thermometer indicates a rectal temperature of 103° to 104° F. (39.5° to 40° C.). The pulse becomes rapid, feeble and perhaps imperceptible at the wrist, the heart sounds are markedly weakened. Respiration continues until death supervenes in a condition of coma. At times the patient may remain conscious until the very end. The continued depletion of the patient during this stage results in great diminution of the secretions, particularly the urine and saliva; the sweat glands and, in nursing women, the secretion of milk remain unaffected. Microscopical examination of the stools reveals the presence of mucus, epithelial cells, numerous bacteria, together with the comma bacillus, and at times blood cells. Chemically the dejecta contain albumin, and the salts of the blood, particularly sodium chloride.

Cholera sicca is the term applied to this disease when vomiting and diarrhœa are absent.

The usual duration of the stage of collapse is from twelve to twenty-four hours although it may last but three or four hours.

c. The stage of reaction, if the patient survives, sets in at the termination of the stage of collapse and is characterized by a reappearance of the secretions, of bodily warmth and of normal facial expression. The skin may retain its mottled appearance for some days or an erythema may appear. The symptoms gradually ameliorate, the heart action becoming stronger; the vomiting and purging gradually diminish and the patient either may recover, there may be a recurrence of the diarrhœa and collapse followed by death, or he may pass into a state termed *cholera-typhoid* which is characterized by cerebral symptoms, heart weakness and dry tongue. From this he may recover or death may take place in coma which is attributed to uræmic poisoning.

Mild instances of cholera, which are termed *cholerine*, are often seen during epidemics. In such there are diarrhœa, vomiting and abdominal cramps, but the collapse is not well marked. Malignant infections may also be observed in which death takes place before the appearance of the purging and emesis, or in which the patient dies early in the disease, comatose and in a profoundly toxæmic state.

Such complications and sequels as nephritis, diphtheritic inflammations of the mucous membranes, and conditions due to septic poisoning, such as parotitis, erysipelas and multiple abscesses may occur. Pleurisy, bronchitis and pneumonia have been observed.

In the differentiation of Asiatic cholera from other conditions likely to be confounded with it the chief points to be kept in mind are the history of association with other instances of the disease, the presence of "rice-water" stools, the presence of painful cramps in the extremities, the occurrence of cyanosis, collapse and suppression of the secretions, especially the urine, and lastly, the presence of the comma bacillus in the dejecta. A preponderance of these symptoms is not likely to occur in any disease except true cholera and, of course, the presence of the spirilla is pathognomonic.

The mortality varies in different epidemics from 30 to 80 percent. The disease is more likely to prove fatal in the debilitated and intemperate than in those of better power of resistance. Patients with marked and early collapse seldom recover.

The prevention of this disease consists in the prompt isolation of all patients afflicted with the disease and the thorough disinfection of all dejecta and the utensils, bed and personal linen of the sufferer. The methods applicable in enteric fever (see p. 15) will be found efficacious in this disease. During epidemics all water and milk used for any purpose should be boiled and it is even unwise to eat uncooked fruit or vegetables. The disease is as slightly contagious as is enteric fever and consequently if proper precautions are taken, those associating with patients are not likely to become infected. The digestion should be kept in perfect order and any disturbance, partic-

ularly if associated with diarrhœa, promptly treated; here opium, lead acetate, small doses of sulphuric acid and the salts of bismuth, particularly those which exert an antiseptic action upon the digestive tract such as the subgallate, the naphtholate and tetraiodophenolphthaleinate, are indicated.

The protective inoculation against cholera by means of Haffkine's virus has proved effective in the hands of its originator and its employment produces no evil after-effects. Other experimenters are said to have elaborated antitoxic sera.

Since, however, we have simpler means, namely, through disinfection, sanitation and efficient quarantine, by which the disease may be prevented, we may remain content until further research has succeeded in establishing an anticholera inoculation which shall be certainly protective.

Treatment. The patient should be immediately isolated and put to bed. During the first stage of the disease treatment should be directed at the diarrhœa, at the destruction of the bacilli within the intestinal tract and at the neutralization of their toxins. Of the drugs most commonly used to check the diarrhœa opium and sulphuric acid may be mentioned. It is probable that the latter is to be preferred, while opium is to be reserved to relieve the pain; for this purpose it should be given hypodermatically in the form of morphine. A full dose, gr. $\frac{1}{4}$ to $\frac{1}{2}$ (0.016 to 0.032), may be given at first, to be followed by smaller doses as indicated. Sulphuric acid has a destructive effect upon the comma bacillus and may be given in the form of the dilute acid, 10 to 15 drops (0.66 to 1.0), every two or three hours. The acid may be given alone or with the camphorated tincture of opium. Hydrochloric and nitrohydrochloric acids are also useful.

Excellent results have been attained from the use of phenyl salicylate in cholera; it may be given in doses of gr. v to xv (0.33 to 1.0) every two or three hours, alone or combined with considerable doses of one of the bismuth salts, either the naphtholate or the iodophenolphthaleinate, these last being among the most effective intestinal antiseptics at our disposal. Calomel has also given good results, not only in controlling the vomiting, but since a portion of this drug is changed in the digestive tract into mercury bichloride, it has an antiseptic effect in addition. It may be given in dosage of from five to seven grains (0.33 to 0.5) at the onset of the disease and continued in smaller doses—$\frac{1}{3}$ to $\frac{3}{4}$ of a grain (0.02 to 0.05)—every two or three hours during the first and second stages of the affection.

If severe vomiting is present we may attempt its control by lavage of the stomach and small doses of cocaine—$\frac{1}{4}$ to $\frac{1}{2}$ a grain (0.016 to 0.032). When this symptom is very marked we should administer all medication hypodermatically. In the control of the diarrhœa external applications are often useful; either mild mustard pastes or turpentine stupes may be employed. For the heart weakness the administration of alcohol and strychnine or of

camphor, dissolved in æther or sterile oil, 1 grain (0.065) every six or eight hours, is indicated.

During the second stage the abdominal cramps may be relieved by hypodermatic injections of morphine and the body heat should be maintained, in this as well as in the algid stage, by means of hot water bottles and, if sweating is a prominent symptom, by the subcutaneous administration of $\frac{1}{100}$ of a grain (0.0006) of atropine sulphate which may check this distressing manifestation.

The continuous depletion of the system by the serous diarrhœa results in marked thirst and serious diminution in the watery elements of the tissues. The thirst may be relieved by allowing small but frequent draughts of water, either plain water, barley water or carbonated water being permissible, and by intestinal irrigations of hot normal saline solution. Water may be supplied to the tissues and the organism stimulated by means of hypodermatoclysis or intravenous injection of considerable quantities of normal saline. As much as two quarts (2 litres) may be given under the skin every four or six hours. It is often wise to begin the hypodermatoclysis in the early stages and to continue it at intervals throughout the disease. During the algid stage the bodily heat may be kept up by immersing the patient in a warm bath.

The patient may receive for hypodermatoclysis, instead of normal saline solution, an artificial serum composed of one drachm (4.0) of sodium chloride and 45 grains (3.0) of sodium carbonate to the quart (litre) of sterile water. This should be injected at a temperature of 104° F. (40° C.) by means of a fountain syringe or irrigating glass to the tube of which a long needle of moderate calibre is attached. The solution should be put under the skin of the buttocks, thighs or back; it is well to avoid the tissues of the neck lest œdema of the glottis be induced. The injection treatment, also recommended, has been followed by excellent results and consists in irrigating the large intestine, through a soft rubber rectal tube passed as high as possible, with an infusion of chamomile flowers, 2000 parts, gum arabic, 30 parts, tannic acid, 10 parts and laudanum, 2 parts. According to the originator of this treatment the tannic acid not only exerts its astringent action but also inhibits the growth of the comma bacillus and has a neutralizing effect upon its toxins. The solution is passed in under gentle pressure, the bag containing it not being elevated more than 18 inches or two feet above the patient who lies upon the left side with the buttocks raised. The fluid should be retained as long as possible and it is said that under favorable conditions it may pass the ileocæcal valve and come in contact with the lining of the small intestine. The injection may be given four times a day and in severe infections may be administered after each movement of the bowels. If the patient is in a state of actual or threatened collapse the solution should be hot—105° F. (40.5° C.)—but should there be tendency to hyperpyrexia it may be cool. The tem-

perature of the fluid in its receptacle if it is to be given hot should be 112° to 116° F. (44.5° to 46.5° C.) since by the time it has reached the body much of its heat will have been lost in its slow passage through the tube. The tendency to urinary suppression is also lessened by the hot irrigations and may be still further combated by means of hot applications over the lumbar region.

During the stage of reaction the substitution for the tannic acid mixture of saline solution (sodium chloride, 10 to 15 percent.) is advisable and when the tissues seem still to be in need of water, as evidenced by thirst and relaxation of the skin, the hypodermatoclysis should be continued at increasing intervals. Stimulants may also be necessary. When convalescence has become established the patient should be still kept at rest and fed with the greatest caution lest the diarrhœa recur. The food should be given at frequent intervals but in very small amounts and must be of the most non-irritating character. Peptonized milk is the first nourishment and may be followed by other peptonized foods. Later more liberal feeding may be permitted and tonics should be judiciously administered.

Complications should receive appropriate treatment.

Dead cholera bacilli in anticholera vaccination have been employed with the result of apparently certain immunization and the Japanese have an antitoxin which is said to be curative, when properly administered, unless the patient is *in extremis*.

DYSENTERY.

Synonym. Bloody Flux.

The term dysentery is applied to a group of infectious inflammatory intestinal affections characterized by ulceration of the intestinal mucous membrane and frequent dejections, associated with pain and often containing mucus and blood. In chronic forms of dysentery constipation may alternate with the diarrhœa.

The conditions to be included under the term dysentery may be classified as follows: *a*, Catarrhal or sporadic dysentery; *b*, tropical or epidemic dysentery; *c*, amœbic dysentery; *d*, diphtheritic dysentery.

Ætiology. Aside from the specific causes of these different types of the disease certain predisposing ætiological factors are common to all forms. Dysentery is especially a disease of warm climates, although its epidemic and other varieties have been observed in northern latitudes. Season also has a distinct influence upon the occurrence of dysentery, the disease being most prevalent during the warm months of the summer and autumn. Damp low-lying regions near the sea shore suffer more frequently than highland and inland districts. Unhygienic conditions of life, unsanitary surroundings

and over-crowding predispose to the incidence of the disease as is evidenced by the epidemics which occur from time to time in army camps, jails, hospitals and the like.

Dysentery affects all ages, both sexes and all races. Barring the proneness of infants to dysenteric disturbances the disease is most commonly seen in young adults. It is predisposed to by all disorders of the intestinal tract and by errors in diet, particularly the eating of unripe or over-ripe fruit.

Catarrhal Dysentery.

Synonym. Sporadic Dysentery.

Ætiology. This form of dysentery is met as a complication of the various acute infectious diseases as well as of chronic wasting diseases, such as tuberculosis. It is predisposed to by the ingestion of irritating and improper food and is the type of dysentery met so frequently in children during the summer months. Here it is usually a primary disease and it may occur as such in adults.

Its specific cause is in all probability the result of the presence and growth in the intestine of the Shiga bacillus or analogous micro-organisms of which several varieties may be present in the same case.

Pathology. The morbid changes depend upon the severity of the infection and may consist merely of an increased production of mucus, exfoliation of the epithelial cells lining the large intestine, exudation of serum and diapedesis of white blood cells. In more marked infections there is swelling of the solitary follicles which is followed by necrosis and ulceration; hæmorrhages from the mucous membrane may occur and this structure may be the seat of a purulent inflammation.

Symptoms. The onset of the disease may be preceded by such prodromata as malaise, abdominal pain, nausea and moderate diarrhœa, or it may be sudden and marked by a chill followed by a slight or moderate rise in temperature which seldom is higher than 103° to 104° F. (39.5° to 40° C.). The typical symptoms are cramp-like pains in the abdomen accompanied by movements from the bowels with tenesmus. At first these number not more than five to six per day, are copious and consist of fæcal matter; soon they become much increased in number, even to 100 or more per day, are small, mucoid and at times bloody.

Microscopic examination of the stools reveals the presence of mucus, red blood and pus cells, epithelial cells, which may have undergone partial fatty degeneration, and the bacteria of putrefaction.

After a week or ten days the stools become less frequent, contain less mucus and blood and are greenish, due to the presence of bile.

Other symptoms manifested in this disease are a coated tongue, at first

moist, later dry, loss of appetite, rarely vomiting, and marked thirst. The patient soon becomes emaciated and a condition of collapse, with small weak pulse and moist clammy skin, may be observed. Occasionally delirium followed by coma and death may be met.

The usual course is one week to ten days after which the stools begin to approach the normal in number and character, but at times the disease will resist treatment for a long period or even become chronic. Death occurs in rare instances from exhaustion.

The diagnosis is to be based upon the character of the stools and the intestinal symptoms. In protracted instances rectal examination should always be made in order to exclude malignant tumor.

Tropical Dysentery.

Synonyms. Epidemic Dysentery; Bacillary Dysentery.

Definition. A specific inflammation affecting the colon and sometimes the small intestine and characterized by the exudation of a false membrane which may be cast off, leaving ulcerating surfaces behind.

Ætiology. This affection is a common disease of tropical and temperate climates and is especially prone to appear where large numbers of persons are gathered under unsanitary surroundings, as in army camps, ships and hospitals. It often appears in epidemics. Its specific cause is the *bacillus dysenteriæ* discovered by Shiga during an epidemic in Japan. Other observers have confirmed his observations in the Philippine Islands and in other countries. This micro-organism is not found in the normal intestine but may persist in this situation after an attack of the disease which may account for the dissemination of the infection in regions where it has been prevalent. It has appeared in the United States since the return of our soldiers from China and from the West Indies. Its mode of transmission is by means of drinking water or other contaminated ingesta.

Pathology. The changes observed depend upon the severity of the infection. In mild forms the mucous lining of the intestine is inflamed, swollen and covered with a croupous exudate which is easily detachable and is composed of necrotic epithelium. In the more severe grades this exudate involves all the coats of the intestine and appears as a grayish or brownish mass of granular surface which may cover the entire lining of the colon or may affect localized areas only. Portions of this pseudo-membrane may be sloughed away, ulcers, varying in extent, being left behind. A follicular form of inflammation may occur without membrane formation in which the intestinal lining is at first swollen and congested, the follicles, especially those of the cœcum, being inflamed and ulcerated. These ulcers may extend to the muscular coat; their edges are ragged and overhanging. Cicatrization may

take place, and ulcerations in all stages may be observed at the same time. In other instances a gangrenous process may follow the diphtheritic inflammation. Here the serous coat is affected and adhesions are common; the wall of the gut is easily torn, is necrotic and dark olive green in color with here and there areas which are quite black. Its lining is the seat of diffuse purulent infiltration with localized areas of necrosis and gangrene. Portions of the mucosa may not be involved in the above described types of inflammation but are the seat of simple catarrhal changes.

Symptoms. The onset is usually sudden and may be characterized by a chill. The temperature rises rapidly—102° to 103° F. (39° to 39.5° C.)—the prostration is marked and cerebral symptoms, even delirium, may be present. The temperature is irregular with remissions from time to time, the pulse is rapid and soon becomes feeble; irregularity of force and frequency may be noted.

There is severe abdominal pain and the stools are frequent, small, dark in color, fœtid and contain mucus and blood. Pieces of pseudo-membrane may be cast off, varying from a small shred to a tube cast of the gut of considerable size. Tenesmus is likely to be a distressing symptom and the abdomen may be distended and tender. In persistent cases the stools are likely to become serous and more profuse. Such dejecta are markedly albuminous, and may be reddish, due to the presence of blood. The patient becomes rapidly weak and emaciated and suffers from thirst; the mouth is dry and the tongue foul and coated. In severe infections there may be delirium followed by coma. Milder subacute types of the disease may occur in which the symptoms are not marked and the stools as few as five or six per day.

The diagnosis may be made upon the rapid development of intestinal and constitutional symptoms, and the appearance of bits of membrane in the dejecta. It is assured by the isolation of Shiga's bacillus from the stools and by obtaining a positive agglutination reaction with pure cultures of this bacillus when mixed with the blood-serum of the patient.

The prognosis in this type of dysentery is distinctly unfavorable, recovery may, however, occur or the disease may become chronic.

Complications, such as localized peritonitis, intestinal rupture with subsequent general peritonæal infection, may be observed. Hepatic abscess is less frequent than in amœbic dysentery. Pleurisy, pericarditis and endocarditis are infrequent complications.

Amœbic Dysentery.

Definition. An inflammation of the large intestine characterized by the formation of ulcers and due to the *amœba coli.*

Ætiology. This disease is most common in tropical countries but has

also been observed in the southern United States and more infrequently in those farther north. It may occur at any age but is most common during the third decade of life and seems to affect males more frequently than females. Its specific cause is the *amœba coli* which is found in the stools, the intestinal ulcerations and in the pus from liver abscesses which commonly complicate the disease. This organism is from 15 to 20 microns in diameter, spheroidal in form and, when living, actively motile. It is composed of two portions, an outer, the ectosarc, and an inner, the endoscarc. It moves by propelling the former, after which the endosarc follows by flowing into the pseudopodia thus extruded. The amœba is phagocytic, taking into its substance red blood cells and other bodies occurring in the intestine. It is said that the virulence of the amœba is much enhanced by the presence of the various pyogenic bacteria.

Its mode of transmission is usually by means of drinking water or upon other ingesta contaminated with infective water, and consequently the disease, of which it is the cause, may be in great measure prevented by proper attention to water supply and by thorough disinfection of the discharges of affected individuals.

Pathology. The intestinal changes are confined almost wholly to the large intestine and are but seldom found in the ileum. The ulceration involves first the submucosa of the gut but spreads thence to the mucosa. The muscularis is rarely, and the peritonæal coat still more seldom, affected. The first changes noted are a number of areas of congestion in the submucous coat; these are followed by necrosis of this and a sloughing process, which involves the mucous coat as well, and leaves behind ulcers of varying size and depth. The peritonæal coat rarely shares in the inflammation and perforation is a rare occurrence. Pus is present in surprisingly small amount considering the extent and type of the process and extensive necrosis of the submucosa may be observed with no or only slight involvement of the mucosa, the inflammation dissecting its way downward and laterally rather than toward the lumen of the intestine. The ulcers may be circular or ovoid, they have ragged floors and overhanging edges and may involve nearly the whole of the colonic lining including that of the appendix. In them the amœbæ are present; these may also be found in the lymph spaces and more rarely in the neighboring blood-vessels.

As the ulcers heal, their bases become covered with fibrous tissue which may later contract and cause strictures or even sacs in which the amœbæ may remain after the patient seems to have recovered. Thickenings and adhesions of the colonic wall may be observed.

The hepatic lesions are probably the result of the entrance of the parasites into the portal capillaries and are of two types: First, multiple circumscribed areas of necrosis, and second, abscesses, single or multiple. The

former lesions are thought to be due to the action of the products of the growth of the parasite, the latter, if recent, contain within their cavities, which are large if single, small if multiple, necrotic matter of semi-fluid consistency and reddish—or greenish—yellow color. On close inspection this is seen to be composed of a spongy net-work of tissue in the interstices of which a viscid fluid is confined. The walls of the recent abscesses are ragged and necrotic while those of long standing are lined by firm, dense fibrous tissue. Microscopic examination of the contents of the abscesses reveals the presence of necrotic liver cells and amœbæ. True pus is not present unless mixed infection has taken place. Such pyogenic bacteria as staphylococci, streptococci, colon bacilli, etc., have been found.

Large single abscesses are usually near the upper or lower surfaces of the right lobe while the small multiple abscesses are scattered through the organ and may be at no great distance from its surface.

Hepatic abscesses may rupture, depending upon their site, into any of the surrounding organs or through the abdominal wall. They may perforate the diaphragm and burst into the lung, whence their contents may be coughed up.

Associated lesions which may be observed are nephritis and cerebral congestion, with or without capillary hæmorrhages.

Symptoms. In cases of acute onset the symptoms are practically those of dysentery due to the bacillus of Shiga (see p. 73). The temperature is seldom high but the patient is greatly prostrated and becomes rapidly and to a marked degree emaciated. Intestinal hæmorrhage or perforation may occur. While recovery usually takes place in two or three months, in severe grades of the infection death may take place within a week or ten days or, the disease becoming chronic, the patient continues to suffer from alternating diarrhœa and constipation, exacerbations occurring from time to time during which the pain and temperature recur and diarrhœa with the passage of mucus and blood makes its appearance. Between the exacerbations the patient enjoys periods of improvement but a recurrence of the symptoms may be brought about by errors in diet or exposure; while often enough the patient's nutrition remains good, in other instances emaciation may be marked.

In another chronic type of the disease the ulceration persists and with it the diarrhœa; the emaciation is progressive and death from exhaustion supervenes within a few months.

The complication to be particularly anticipated is liver abscess, the presence of which is evidenced by an increase in the area of liver dulness, pain, leucocytosis and a temperature of septic type accompanied by chills and sweating. Other possible complications are peritonitis, intestinal hæmorrhage or perforation, pylephlebitis, pleurisy, pericarditis, endocarditis and arthritis. Malaria and enteric fever have been observed in co-existence with this disease.

The diagnosis of this affection is to be based upon the finding of the amœbæ in the patient's dejecta. They should be searched for upon a warmed stage and a positive diagnosis should not be made unless amœboid movement is observed.

The prognosis of amœbic dysentery in epidemics and without proper treatment is unfavorable; in sporadic cases the mortality is low. Recurrences are prone to occur and in the patients in whom the disease is complicated by hepatic abscess the chances of recovery are greatly diminished.

Diphtheritic Dysentery.

This form of dysentery occurs secondary to the acute infectious diseases, pneumonia, enteric fever, etc., and to certain chronic affections such as endocarditis, nephritis and pulmonary tuberculosis.

Pathology. While termed diphtheritic this condition is not a result of Klebs-Löffler infection. It is characterized by the appearance of a pseudo-membranous exudate of yellowish or grayish color upon the mucous lining of the intestine and by necrotic ulcerative areas. The supporting connective tissue of the colonic glands is inflamed and infiltrated with fibrin and pus cells. The process may involve the muscular and peritonæal coats as well. The inflammation may be confined to the rectum or the whole colon may be involved, its entire surface being covered with the exudate or merely scattered areas of pseudo-membrane being present. In markedly severe instances the necrotic patches may slough leaving ulcers behind which either cicatrize or remain active for long periods.

Symptoms. The onset of this disease is gradual, being characterized by the appearance of slight or moderate diarrhœa, the stools being fluid, not often accompanied by pain or tenesmus and seldom more than from three to five daily. In mild instances the passage of mucus and blood is rarely observed but in the severer types of the disease these, with shreds of membrane, may appear in the dejecta. The affection is usually subacute or chronic in its course and is associated with emaciation. Death may take place from asthenia.

The Treatment of Dysentery.

Under this caption the means applicable to the treatment of all types of the affection will be first discussed, to be followed by a description of those especially indicated in the different forms of the disease.

General Considerations. In all forms of dysentery the prophylaxis consists in boiling all possibly contaminated drinking water, disinfecting and destroying the patient's dejecta and in taking all the other precautions laid down in the section upon the prevention of enteric fever (p. 15). Much work

has been recently undertaken along the lines of preventive inoculation against bacillary dysentery and it is quite probable that we may in the not far distant future have at our disposal an effective immunizing serum against Shiga bacillus infection.

At the onset of any of the varieties of dysentery the patient should be immediately put to bed and if the catarrhal type is the one in hand a purge of castor oil, one ounce (30.0) with 20 grains (1.33) of sodium bicarbonate should be given.

The pains and tenesmus may be controlled by the application to the abdomen of turpentine stupes or mild sinapisms and by the administration of Dover's powder by mouth. In instances where these means fail morphine may be given hypodermatically.

The feeding of the patient offers difficulties, for we have a disturbed digestive tract and one which must be irritated as little as possible, and at the same time we have to combat a disease, one of the most prominent characteristics of which is loss of strength and emaciation. Milk has its disadvantages since the curds which are formed in the stomach may be impossible of digestion by an alimentary tract the powers of which are impaired; the curds also are excellent culture media for the growth of the micro-organisms which are present in the intestine. Curd formation may be prevented by taking the milk in small amounts and diluted with lime water or vichy or barley water, or in the form of kumyss or zoolak. Peptonized milk may also be tried, soups and broths may be permitted. When milk is not well borne easily digestible semi-solids, which may be partly predigested by means of pancreatin or diastase, such as soft boiled eggs, meat jellies, milk toast, junket, etc., are allowable.

The diet in the protracted forms of diphtheritic or amœbic dysentery may be more liberal. While milk plays an important part here, such nourishing and easily digestible solids as raw oysters, cereals, poultry and fish may be given in small quantities and tentatively. As the patient recovers a still more liberal dietary may be gradually permitted.

Various forms of drug treatment may be employed in catarrhal and bacillary dysentery; the so-called saline treatment is indicated particularly in sthenic cases with high fever and in many instances achieves excellent results. Instead of the initial dose of castor oil, a purgative dose of magnesium sulphate or sodium and potassium tartrate is given and the intestine is thoroughly evacuated. Then, upon the theory that intestinal micro-organisms cannot exist or at least are inhibited in their growth by an acid medium, aromatic sulphuric acid is given in 20 drop (1.33) doses three times a day. By this means, not only are the intestinal bacteria retarded in their development, but the astringent action of the acid is also exerted.

The ipecac treatment may be employed in all forms of dysentery and is

to be carried out as follows: The drug is administered upon the empty stomach and it may be wise to apply counter-irritation over the stomach in the form of a mild mustard paste or by painting the skin with iodine before giving the ipecac. The amount of this drug which is administered is large and under ordinary circumstances would produce emesis, consequently the patient should not be told of what the medication consists and he should be warned not to vomit if he can avoid it. The size of the dose is in proportion to the severity of the disease and weakness is not a contra-indication. Preceding the administration of the ipecac a dose of 10 to 15 drops (0.66 to 1.0) of tincture of opium is given and after a quarter of an hour from 15 to 60 grains (1.0 to 4.0) of ipecac, depending upon the age of the patient and the type of the infection, are taken. The drug may be given in pill form or suspended in a little water to which a little peppermint or anise oil has been added. Should emesis be induced the dose should be repeated as soon as the stomach is at rest. The ipecac may be given for considerable periods, the dosage being diminished as the dysentery becomes less marked in severity.

Intestinal antiseptics may be employed as advised in the treatment of chronic diarrhœal conditions (see p. 397), but are usually less effective than the forms of treatment described above.

Treatment by means of intestinal irrigations often brings about good results. The apparatus necessary consists of a fountain syringe to which a long rectal tube of soft rubber is attached. When the intestine is very irritable it may be wise to pass a soft catheter beside the tube to carry off the return flow and prevent distention of the bowel. Forcible irrigation is contraindicated, a gentle flow, the receptacle containing the fluid to be used being held at a height not greater than three or four feet above the patient, being preferable. Careful introduction of the tube is necessary and a skilled hand may often succeed in passing the same well beyond the sigmoid flexure. The discomfort accompanying its passage in instances of severe tenesmus may be obviated by the insertion of a cocaine—gr. $\frac{1}{4}$ to $\frac{1}{2}$ (0.016 to 0.032)—and iodoform—gr. viii (0.5)—suppository shortly before the procedure. The quantity of the irrigation selected may be from one to two gallons (4 to 8 litres) although irrigations so large in amount may at first be intolerable to the patient, we may, by beginning with small quantities, gradually increase until the bowel becomes tolerant and the patient's discomfort endurable. The insertion, previous to the injection, of such a suppository as that given above or the injection of a drachm (4.0) of tincture of opium in a little starch water will often render the subsequent irrigation well borne. The temperature of the irrigation is an important consideration, cold irrigations being indicated in sthenic cases while, when stimulation is desirable, higher temperatures are advisable. Tepid irrigations are seldom employed.

Various solutions have been employed in the different types of dysentery.

In the simple catarrhal and the diphtheritic forms simple cold water, or hot saline solution may be employed. Here also astringent solutions such as alum (2 percent.), zinc phenolsulphonate (0.25 percent.), silver nitrate (0.25 percent.), tannic acid and salicylic acid (1 to 2 percent.), silver-protein—protargol—(0.75 percent.) are of use. An infusion containing 45 grains (3.0) of ipecac is said to be useful. Those particularly indicated in bacillary dysentery are antiseptics, silver nitrate and protargol in the strengths given above, methylthionine hydrochloride gr. x (0.66) to a quart (1 litre) of saturated solution of boric acid, potassium permanganate (0.025 percent.). In amœbic dysentery an approved irrigation is of quinine sulphate, 1 to 5,000, gradually increased to 2 to 1,000. Mercury bichloride 1 to 1,000 to 1 to 6,000 may be used. Such irrigations consisting of from two to four quarts (2 to 4 litres) are given twice a day. Recently it has been found that irrigations of copper sulphate solution of a strength of 1 to 6,000 or less are very efficient. The irrigations are given twice a day, and the colon having been filled, the fluid is retained for twenty minutes if possible. A preliminary cleansing of the gut by means of the injection of sterile water is advisable. This water should be allowed to drain away before the medicated irrigation is given. Enemata of ice water are also useful in this type of the disease. Hydrogen dioxide, both in amœbic and bacillary dysentery, may be injected *per rectum* as a parasiticide.

Cases of tropical dysentery are reported as being favorably influenced by drinking sulphur waters, and sulphur in connection with pulvis ipecacuanhæ et opii has been suggested for internal administration; 15 or 20 grains (1.0 to 1.33) of the former and five grains (0.33) of the latter may be given every four hours. In this form of dysentery excellent results are said to follow the administration of the fluid extract of cortex granati and of *aplopappus balayhuen*, a South American drug and one used there in dysentery.

In dysentery of the chronic type pure olive oil may be tried. It is said to act as a cholagogue, and to decrease the number of bowel movements and the tendency to intestinal fermentation and putrefaction.

Much research has been carried out in the attempt to elaborate an antidysenteric serum and while in some instances favorable reports have been made of the results of these endeavors, as yet we have no specific serum which may be relied upon.

Before concluding it is well to mention the surgical management of chronic dysenteric conditions. This consists in the formation of an artificial anus through which the bowel may be irrigated. It has been suggested that the appendix, being opened and fastened to the edges of a colostomy wound, may be used in this way. When rectal ulcers exist in subacute or chronic instances they may be opened under anæsthesia, scraped and touched with caustic. They then should be irrigated with warm normal saline solution and, when

healed, the employment of irrigations of silver nitrate, 1 to 500 to 1 to 250, is advised.

EPIDEMIC GANGRENOUS PROCTITIS.

Definition. An acute infectious disease characterized by rapidly progressing ulceration of the rectum resulting, in certain instances, in prolapse and gangrene.

Ætiology. This affection occurs in certain parts of Central and South America, the Philippines and in islands of the Malay Archipelago. Children are more frequently attacked than adults and in Northern South America the latter are not affected. The disease is favored by unsanitary conditions and malnutrition, and marked humidity is probably necessary to its occurrence. It has been attributed to the eating of unripe maize but, since the affection has been reported in regions where this cereal is unknown, this cannot be held responsible for all cases. The essential factor in the ætiology of epidemic gangrenous proctitis is probably a micro-organism, although possibly not a specific one, since by some it is not regarded as a distinct disease but is considered merely a dysentery of severe type, the lesions of which are, for some unknown reason, confined to the colon.

Pathology. The typical lesions of this disease consist of deep ulcerations of the rectal mucous membrane occurring low in the viscus between the two sphincters or higher than this point, even involving the lining of the sigmoid flexure, and covered with a pseudo-membranous exudation. In the severest forms of the affection there is rectal prolapse with gangrene of the extruded portion.

Symptoms. The invasion of the disease is characterized by burning and pruritus of the anal region followed by symptoms resembling those of dysentery. The dejecta are fæcal at first and very foul, later they are mixed with mucus and finally consist merely of blood and mucus which runs sluggishly but constantly from the anus. Tenesmus is present, progressive weakness, even to collapse, is manifested and there are pronounced cerebral symptoms—delirium or coma. Death in convulsions may supervene, or, the patient surviving, rectal prolapse takes place, the prolapsed portion of the gut soon sloughing.

The differential diagnosis from dysentery may be made by means of proctoscopic examination. The prognosis of the disease is distinctly unfavorable but even the most severely affected patients sometimes recover. After sloughing of the prolapsed rectum recovery has been observed, the process being analogous to that which takes place in a sloughing intussusception which heals spontaneously.

Treatment. Taking into consideration that this affection is probably

due to an infectious process localized in the rectum, the indication for treatment would seem clear, namely, to render this viscus as antiseptically clean as possible. For this purpose injections of mercury, bichloride solution (1 to 10,000 to 1 to 6,000), of hydrogen dioxide, of weak creolin solution, of silver vitellin (20 percent.), etc., may be employed. The prolapsed rectum should not be reduced but should be cleansed and kept dusted with bismuth subgallate (dermatol), thymol iodide (aristol) or other similar powder. Surgical procedures are indicated when gangrene takes place.

HILL DIARRHŒA.

Definition. An acute diarrhœal disease characterized by whitish stools occurring in the morning and a tendency to abdominal tympanites.

Ætiology. This disease is seen in the mountainous regions of British India in persons who are accustomed to residence in the tropics but have gone from lowland to highland districts.

Marked humidity and a high altitude seen to be the chief predisposing factors in its occurrence. Its specific cause has not been determined.

Pathology. The pathogenesis of this disease is probably based upon a transient disorder or cessation of the hepatic and pancreatic functions which may be the result of the effort of an impaired digestion to accommodate itself to unusual meteorologic conditions. By certain observers it is considered to be induced by the effect of the unusual cold and dampness of the early morning of tropical mountainous climates upon the atonic colon which is likely to be met in those who have lived in hot countries for considerable periods of time.

Symptoms. The disease is evidenced by disordered digestive function and the appearance of a morning diarrhœa. The stools increase progressively in number until there are 8 or 10 daily, the first appearing about daybreak, the last about noon or shortly before this time. The dejections are colorless, of large size, pasty or frothy, and of sickish odor. Pain is not marked though there may be slight discomfort referred to the region of the colon. Abdominal cramps and tenesmus are conspicuously absent. Abdominal distention is a prominent symptom and there is manifest digestive disturbance characterized particularly by discomfort after meals. This disease is analogous to sprue but differs from the latter in its tendency to recovery after a few weeks. Certain cases may progress and terminate in true psilosis, while others persist until the patient returns to a lower altitude.

Treatment consists in combating the tendency to digestive disorder by means of a diet of milk and other easily digestible fluids and by keeping the patient in bed until the noon hour. Cholagogues, especially calomel in small doses, are indicated and the administration of pilocarpine hydrochloride,

$\frac{1}{8}$ to $\frac{1}{3}$ of a grain (0.008 to 0.022), is suggested with a view to increasing the pancreatic secretion.

Artificial digestive ferments particularly pancreon and pancreatin may prove useful. Cases which are uncontrollable by ordinary means must be sent to low-lying districts.

SPRUE.

Synonym. Psilosis.

Definition. A disease of tropical countries characterized by a catarrhal inflammation of the entire digestive tract which results finally in glandular atrophy and which is evidenced clinically by sore mouth, diarrhœa and distention of the intestines with gas.

Ætiology. This disease is common to all tropical climates and prevails particularly in India, Southern China and the Malayan Archipelago Authorities differ as to whether sprue is a specific bacterial infection or originates secondarily to the diarrhœal and other wasting diseases, malaria, etc., which are common in the tropics. The fact that no bacterial cause for the disease has yet been isolated is against the former hypothesis. Various microorganisms and intestinal parasites have been considered as causes of the affection but their occurrence is probably a coincidence or they are present as a result of preceding morbid conditions. The strongyloides intestinalis, the amœba coli and several varieties of bacilli intermediate between the colon bacillus and the bacillus of enteric fever are frequently found. Predisposing factors to the incidence of sprue are fatigue and over-exertion, pyæmic conditions, the puerperal state, nephritis, and in fact, any influence which tends to vitiate the bodily power of resistance. The affection usually shows itself during tropical residence but may not occur until the patient has returned to temperate regions; it may remain inactive in the system for years.

Pathology. The changes found after death from sprue consist of atrophy of the mucous membrane and glandular structures of the small intestine. The latter may be entirely destroyed, but while the intestinal wall is greatly thinned, the peritonæal coat is unaffected. The agminated glands may be swollen or ulcerated and dysenteric ulcerations may be present in the large intestine. The mesenteric and subcutaneous fatty tissue has wholly disappeared. The parenchyma of the liver, pancreas and kidneys may be the seat of an inflammatory process or of localized fatty degeneration. The mucous membrane of the mouth is eroded, ulcerated and cracked.

Symptoms. The typical manifestations of sprue are sore mouth, irregular diarrhœa and tympanites. The tongue is seldom coated, it is yellowish in color, pointed and shrunken and tiny aphthous ulcers are often present at its edge and upon its ventral surface. These lesions may also be observed

upon the hard and soft palates. The dorsum of the tongue is dry and shining, or it may be the seat of very shallow erosions which may unite to result in a serpigenous formation. Fissures may be present and the patient complains of buccal soreness which is increased upon taking salty or highly seasoned food. Pain on swallowing may be noted, showing that the œsophagus is probably in a condition analogous to that of the tongue.

Emaciation is marked and the abdomen is tensely distended and tympanitic. Eructations are frequent and either gas or watery fluid may make its appearance in the throat as a result of this symptom. The appetite may be excessive or entirely lost. Nausea and vomiting uninfluenced by eating may occur. Gastric discomfort and pain often are associated with the flatulence.

The diarrhœa is a characteristic manifestation, the movements varying from one to a dozen in the 24 hours. They are large, acid, fœtid, white and frothy, resembling whitewash, and are usually unaccompanied by pain. Microscopical examination reveals bits of the mucous lining of the gut, microorganisms and perhaps a small number of red blood-cells.

The patient becomes rapidly weak and emaciated as a result of the impairment of assimilation due to the interference with the action of the intestine and the inability to retain food. The skin is sallow and yellowish and secondary anæmia is marked, the leucocytes are not increased in number. Attacks of tetany have been noted. The course of the disease is chronic with no tendency toward spontaneous recovery, although temporary improvement may be observed from time to time. The patient may recover unless the mucous lining of the intestine is so atrophied as to render sufficient assimilation impossible. The affection usually lasts for a year or two but a much more protracted course is not rare.

Treatment is principally dietetic. The patient should be kept in bed and fed upon frequently repeated small quantities of milk. As rapidly as possible the amount of milk should be increased. Whether the patient is receiving too much is indicated by its appearance undigested in the stools and increase in the soreness of the mouth. In favorable cases after a month or more the buccal symptoms and the diarrhœa will begin to disappear. Successes have been reported to have followed a diet entirely of meat or meat juice, and certain observers consider the use of minced meat, five ounces (160.0) three times a day as important. Antiscorbutic treatment has been advised, and a fruit diet, particularly a regimen of berries, is said to have produced rather remarkable cures. Strawberries are reputed to have achieved cure in obstinate instances of the disease.

In the control of the diarrhœa the intestinal antiseptics, particularly the salts of bismuth, the naphtholate and the tetraiodophenolphthaleinate, may be employed and, when convalescence has become established, general tonic treatment by means of iron, arsenic and strychnine is indicated.

THE PLAGUE.

Synonyms. Bubonic Plague; Black Death; Malignant Adenitis; The Pest.

Definition. An epidemic contagious febrile disease characterized by swelling and inflammation of the lymph glands and hæmorrhages into the skin and mucous membranes.

Ætiology. The disease is endemic in India and from time to time epidemics have appeared in various European countries. Patients suffering from the disease have been brought to New York and instances of the affection have been observed amongst the Chinese in San Francisco.

The plague is most common during the hot months and is seldom seen in individuals beyond middle life. The chief predisposing factor is lack of proper hygiene, the infection being usually met in crowded and filthy quarters and amongst the poor and ill-nourished.

The specific cause of the affection is the *bacillus pestis* which was discovered in 1894 by Yersin and Kitasato.

Transmission and Modes of Infection. The contagium of bubonic plague may enter the body through the respiratory or digestive tracts or through abrasions of the skin and is found in the blood of patients and in the pus from the suppurating glands. It is given off in the fæces, urine and sputum and contaminates clothing, bed linen, apartments and the like. It may be carried by fleas and other insects and by rats, mice, dogs, etc.

Pathology. The skin and the digestive tract are the seat of punctate extravasations of blood; these are also found upon the serous membranes and upon the capsules of the viscera. The latter and the central nervous system are congested. The spleen is enlarged. In the bubonic type of the disease the lymph glands, particularly those of the axillæ and groins, are swollen and inflamed and often undergo hæmorrhage, suppuration and necrosis. The peri-glandular tissue may be involved in similar changes. In these glands the bacillus pestis is found and, after suppuration has taken place, with it other pathogenic bacteria are associated. The lymph system is affected in all types of the disease but in the bubonic form a particular set of glands will be chiefly involved. In the pneumonic variety the bronchial lymph nodes are especially affected and areas of broncho-pneumonia exist in the lungs. Here the bacilli are found in the sputum.

Symptoms. The disease occurs in two main types, 1. *pestis minor* and 2. *pestis major*. The latter is met in three varieties: *a*. The bubonic form. *b*. The septicæmic form. *c*. The pneumonic form.

Pestis minor, abortive or ambulant plague, is seen usually just before or at the termination of an epidemic. The patient is seldom very ill but is a great danger to the community since his excreta contain the contagium. The

attack lasts several days and is characterized by mild fever, and swelling and tenderness of the inguinal glands. Suppuration may occur.

Pestis Major. The incubation period is from three to seven days; during the day or two before the onset of the disease the patient may complain of indefinite malaise, dizziness and general pains. The invasion, which may be without prodromata, is marked by a chill or chilly feelings followed by a rapid rise in temperature to 104° to 106° F. (40° to 41.1° C.). The pulse is rapid, and some nervous symptoms and prostration are marked and the patient may die in collapse. Should he survive, about the third to the fifth day the glandular swellings appear, the inguinal lymph nodes being affected in the majority of cases. These become red and tender and may resolve, suppurate or become gangrenous. Petechial hæmorrhages take place into the skin and there may be bleeding from the various mucous membranes, gastric, intestinal, pulmonary, etc.

In *the septicæmic type* of the infection the bacilli are found in the blood stream, the patient is profoundly poisoned and is likely to die before the glandular swelling takes place. The typhoid condition is rapidly developed and hæmorrhages are common.

The pneumonic form of the disease is sudden, in onset with a chill, rise in temperature, cough and pain in the chest resembling those of lobar pneumonia. Physical signs of pulmonary consolidation may be obtained, the sputum is mucoid and contains blood and the bacillus pestis in large numbers. This form of plague is very fatal, the patient seldom surviving more than three days.

The diagnosis may be made upon the appearance of the glandular tumors and upon the occurrence of the bacillus in the excreta and blood.

The prognosis is markedly unfavorable; from 70 to 90 percent. of those afflicted usually perish. The septicæmic and pneumonic varieties are especially fatal. Suppuration of the buboes is a favorable sign while the occurrence of hæmorrhages is the contrary.

Treatment. *Prophylaxis* consists in the establishment of proper sanitary conditions, the extermination of rats, isolation of patients, careful disinfection of their excretions, of bed clothing, apartments, etc., and cremation of the dead.

Much can be done toward immunization since the work of Haffkine and Yersin in the elaboration of protective sera. Of Haffkine's serum the dose is about 38 minims (2.5) and by its use, according to reports, the death rate may be markedly diminished and epidemics controlled.

The treatment of the attack is to a great extent symptomatic. At the onset the bowels should be opened by means of fractional doses of calomel followed by a saline. The fever may be controlled by cool sponge baths.

The coal tar antipyretics should not be given on account of their depressing effect upon the heart. For the nervous symptoms the bromides may be

administered but for these and the pain the hypodermatic exhibition of morphine often becomes necessary. For the tendency to heart weakness and collapse stimulants such as ammonia, alcohol, strychnine and camphor dissolved in æther or sterile olive oil, are indicated. The glandular swellings may be treated by means of cold applications, or poulticed. When the presence of pus is manifest they should be promptly incised and drained. The injection into the buboes of mercury bichloride has been employed with good results.

Phenol is recommended and has given excellent results. It is given in doses of 12 grains (0.8) every two hours (144 grains—9.6 daily) and when taken well diluted causes no disturbance except carboluria.

Much research has been conducted in the hope of producing an effective antiplague serum and at least two antitoxins have been elaborated which are useful. That of Yersin seems to be considered more effective than that of Haffkine. The former is considered by certain observers to be of great value. Its action is said to be bactericidal, as evidenced by the degeneration induced in the bacilli, and antitoxic as well. In order to achieve the best results the serum should be given in large doses early in the disease, both intravenously and under the skin of the lymphatic area which drains toward the bubo. In mild instances of the disease the latter method will often suffice but in marked infections the combined method is necessary, the beginning dose being about 5 to 10 drachms (20.0 to 40.0), the intravenous dose varying with the severity of the intoxication. No evil results are reported as due to this treatment.

CLIMATIC BUBO.

Synonyms. Tropical Bubo; Tropical Adenitis.

This affection consists of a non-venereal subacute inflammation of the inguinal glands associated with a remittent fever lasting several weeks. It is observed on the tropical coasts of Asia and Africa, in the Philippines and the Malayan Archipelago, and in the West Indies.

It is prone to affect persons living in close association amid unhealthy surroundings and is met in epidemics. Its chief importance consists in the fact that it may be mistaken for *pestis minor* from which it is bacteriologically entirely distinct. Its ætiology is not definitely known but it has been considered to be a bacterial infection which effects an entrance by means of abrasions upon the legs or about the genitalia or by means of the stings of insects. It has also been considered as occurring secondarily to dysentery and chronic malaria.

Symptoms. These consist of unilateral or bilateral inflammation of the inguinal glands or those about the saphenous opening, preceded by a chill,

general pains and malaise. A remittent fever follows. The glands increase in size for from three to four weeks when the fever subsides by lysis. The glandular tumors remain for several months and slowly resolve. In a small percentage of cases the tissues about the glands become involved and suppuration takes place, the constitutional symptoms under such conditions are marked. If not opened the abscesses tend to spread and finally burst discharging pus. The discharge continues for varying periods, finally ceasing and leaving behind sluggish painful ulcers.

Treatment. This is entirely symptomatic and surgical. Until suppuration occurs the buboes should receive inunctions of unguentum Credé, 10 percent. ichthyol or compound iodine ointment. If they subside without pus formation, in their declining stages inunctions of unguentum hydrargyri and snug bandaging are indicated. As soon as the presence of pus is apparent, free incision, drainage and dressing with antiseptics are necessary. The ulcers which follow suppuration should be treated in accordance with surgical principles. It is said that calomel dusted over their surfaces will relieve the pain.

DIPHTHERIA.

Synonyms. Membranous Croup; Angina Malignum; Putrid Sore Throat.

Definition. An acute infectious febrile disease characterized by inflammation and the formation of a false membrane in the upper air passages, particularly in the pharynx. The specific disease, diphtheria, is the result of infection with the Klebs-Löffler bacillus. To the affections of similar clinical appearance, but of usually milder course, which are not due to this bacillus, the terms diphtheroid and pseudo-diphtheria are applied. Diphtheria has been known since the time of Galen and from time to time has occurred epidemically. Its specific nature, however, was not distinctly proven until the discovery of the *bacillus diphtheriæ.*

Ætiology. The disease occurs chiefly in children and is rare after the age of 16 years. It is seldom seen in very young infants especially in those who are breast fed. It is predisposed to by the presence of nasal or pharyngeal catarrh, a poorly cared for mouth and teeth, adenoids and enlarged tonsils, and is most prevalent in the cold and damp months. It appears rather amongst unsanitary surroundings than in healthy districts, although severe epidemics have been observed in the country. Bad drainage and emanations of sewer-gas have never been proven to have any direct influence upon the incidence of the disease and when the infection occurs where these factors are present, save in so far as residence in places exposed to their influence is likely to depreciate the general health and lessen the powers of resistance, they are not causative.

The specific cause of diphtheria is the Klebs-Löffler bacillus, a non-motile, short, slightly bent bacterium with rounded ends. This organism may be found in the false membranes of the disease and in its growth produces a poisonous substance which is responsible for the constitutional symptoms. With the diphtheria bacillus other pathogenic bacteria are often associated which may be held responsible for the purulent inflammations which frequently complicate the disease. Of these the *streptococcus pyogenes* is the most important. It is an interesting fact that the diphtheria bacillus may be found in the mouths of healthy persons in whom it causes no symptoms. This fact may be due to a lack of virulence on the part of these bacilli, a natural immunity, or sufficient power of resistance upon the part of the individual to render them inert.

The contagium is transmitted upon the air or by means of ingested substances and may be received from the membranous exudate or nasal or pharyngeal secretions of patients either actively ill or convalescent from the disease or from persons who have come in contact with sufferers. The disease is markedly contagious for the distance of a few feet but fortunately its contagium is not very diffusible, consequently it is quite possible to confine it to a single room. The contagious material is resistant and of considerable viability and may remain upon clothing, etc., for a number of months.

Previously it has been believed that diphtheria might be conveyed to man by means of contagion from cats, calves and fowls which were affected by a disease of identical causation, but it has been proven that the diphtheria of these animals is a different affection and is not communicable to human beings.

Pathology. The characteristic pseudo-membrane of diphtheria may be found in various situations. Of these the throat, the tonsils, pharynx and larynx, including the epiglottis, are most frequently affected. The membrane commonly occurs upon the nasal mucous membrane, in the trachea and in the bronchi. Less frequent situations are the œsophagus, the stomach, the duodenum, the vagina, the vulva, the ear and the conjunctiva. The nasal accessory sinuses may be involved and the process may extend to the middle ear through the Eustachiun tube.

The membrane is first yellowish-white in color, later becoming grayish. Early in the disease it is firmly attached to the underlying mucous membrane and, when detached, leaves abrasions, later it is softer and more easily removed. In extreme instances the mucosa beneath may be gangrenous. The adjacent lymph glands are enlarged and the salivary glands may be swollen.

Similar membranous inflammations may occur in scarlatina, measles, pertussis and enteric fever. These are usually the result of streptococcus infection and are termed diphtheroid.

The diphtheritic membrane is the result of a degenerative necrosis of the

mucous membrane. The epithelial cells are infiltrated with fibrin and leucocytes, necrose, and then undergo a hyaline transformation and coagulation. To this process the term "coagulation-necrosis" has been applied. The membrane histologically is composed of coagulated fibrin, necrotic tissue and the diphtheria bacilli.

The *heart* is frequently the seat of fatty degeneration which may precede a hyaline change in the heart muscle. Endocarditis may be present with vegetations in which the bacilli are found. This latter complication, with pericarditis, is rare.

Broncho-pneumonia is often present; the kidneys are the seat of an acute degeneration or a true acute nephritis. The liver and spleen are softened and degenerated (cloudy swelling).

Symptoms. The incubation is usually two or three days, rarely as long as a week. The onset is marked by chills, or, in children, a convulsion, followed by a rise in temperature; there are headache, bodily pains, nausea, vomiting and prostration, but in the mild types of the disease these symptoms may be very slight. The temperature is not a marked feature; it rises to 102° to 104° F. (37.8° to 40° C.). The pulse is rapid—120 to 140—and is usually small and feeble. Cerebral symptoms are infrequent.

In the *pharyngeal type* there is complaint of sore throat and difficulty in swallowing. The pharynx and tonsils are inflamed and swollen and upon the latter there are yellowish spots which gradually enlarge, becoming grayish in color, until by the third or fourth day the tonsils are entirely covered and the pillars of the fauces and the soft palate may be involved to such an extent that the opening of the pharynx may be wholly occluded. The cervical glands are swollen. In the ordinary infection the patient is not markedly poisoned and the symptoms soon abate. In about a week or ten days the glandular swellings have disappeared with the false membrane, leaving the pharynx clean, the temperature falls and the patient is convalescent.

In *nasal diphtheria* the onset is marked by the usual constitutional manifestations and an increased nasal discharge which irritates and often excoriates the upper lip. The glands beneath the angle of the mandible are swollen and indurated. This enlargement is characteristic and is probably due to the fact that the nasal mucosa is particularly rich in lymphatics. Many instances of nasal diphtheria are of severe type with marked constitutional symptoms and antral, aural or ocular complications are frequent. A peculiar form is sometimes met in which constitutional manifestations are absent; the nostrils are occluded by typical membranes in which the bacilli are present but the infection is characterized by a benign course.

Laryngeal diphtheria or membranous croup is characterized by a laryngeal cough at the onset and by the gradual development of obstruction. The latter may, however, appear suddenly at night. The respiration is rapid

and difficult, the expiration particularly being interfered with, the abdomen and lower thorax are retracted in inspiration and the mucous membranes and extremities become cyanotic from lack of oxygen. The patient becomes restless and may fall into a semi-coma and die of asphyxia. In milder instances the paroxysm may last but a short time and the patient will gradually become quiet. The attack is, however, likely to be repeated during the following night. At times relief will follow the coughing up of the membrane, in part or as a whole. The constitutional symptoms are often not marked but when there is an accompanying pharyngeal membrane the opposite is usually the case.

Membranous croup occurs in two varieties, the clinical appearances and symptoms of which are so similar as to prevent their differentiation except by bacteriological examination. Cultures alone will determine whether the affection is due to the streptococcus or to the diphtheria bacillus.

Diphtheria in other parts is rather infrequent but the inflammation may affect the conjunctiva, either primarily or by extension through the lacrymal duct, the skin, especially about the lips and nostrils and the external auditory meatus by extension from the middle ear. The genitals may be involved, whence the inflammation may spread to the surrounding skin, and diphtheritic inflammations may occur in open wounds which have been infected by the bacillus.

The symptoms of constitutional injection in mild infections are not marked. In more severe instances, three or four days after the onset, the patient's condition becomes one of great weakness, the heart action is feeble and cerebral symptoms are present. At this time there is great danger of death from paralysis of the heart. In other patients the constitutional symptoms are prominent from the beginning, the temperature is high and the evidence of toxæmia pronounced. As a rule the constitutional symptoms are directly proportional to the local involvement.

A marked leucocytosis is usually present in diphtheria even of mild type and albuminuria occurs in nearly all severe infections.

Complications and Sequelæ. The slight albuminuria which is so commonly seen is not to be attributed to nephritis but the appearance of blood and epithelial casts and the occurrence of diminution of the urine indicate that serious kidney involvement is present. Œdema is less frequent than in scarlatina and, while the nephritis of diphtheria usually terminates in recovery, it may cause death. Bronchitis and bronchopneumonia are important and serious complications. Pericarditis and endocarditis are rare. The heart is often irregular and an apical systolic murmur is present in a large majority of instances. Heart weakness, evidenced by rapid and galloping rhythm and by sudden diminution in the pulse rate, is a serious manifestation. The cardiac symptoms usually appear from the

10th to the 20th day of the disease but fatal acute dilatation may occur in convalescence, even as late as the seventh week.

Minor complications, such as nasal or pharyngeal hæmorrhage, various skin eruptions and jaundice, are not uncommon.

Paralysis is a most important sequel and is a result of neuritis due to the toxins of the disease. It may appear as early as the seventh day or not until convalescence and as frequently follows mild as severe cases. It occurs in 10 percent. to 20 percent. of patients and is more frequent in adults than in children. The palate is most often affected and involvement of this structure is evidenced by nasal voice and the regurgitation of food through the nostrils. The pharynx is anæsthetic. Involvement of the muscles of deglutition is also frequent and various ocular palsies are not rare; neuritis may occur in the extremities resulting in permanent disability. Recovery usually takes place from these paralyses within a few weeks. Multiple neuritis may be observed which may rarely involve the innervation of the heart and the respiratory muscles, in which event the patient's condition is dangerous.

The diagnosis can be assured only by bacteriological examination of the false membrane; fortunately this is not a difficult procedure, and where there is no health department affording facilities for laboratory diagnosis, it may be carried out by the practitioner. For a description of the technique the reader is referred to any good work upon clinical diagnosis.

The prognosis since the introduction of the antitoxin treatment has been rendered vastly more favorable than previous to this event. By this remarkable therapeutic advance the mortality from diphtheria has been reduced from 30 percent. to 50 percent. to from 10 percent. to 15 percent. The prognosis is excellent in the usual infections. Complications and laryngeal involvement render it less good. Sudden heart failure, paralyses and uræmia may result fatally.

Prevention. Prophylaxis in diphtheria has been further developed and is more successful than in any other infectious disease save smallpox. The following condensation of the rules concerning the disease laid down by the New York Health Department covers the subject of prevention very thoroughly.

If possible one person should take entire charge of the patient and no one else except the physician should be allowed in the sick-room. The nurse should hold no communication with the rest of the family, who should not receive or make visits during the illness. Discharges from nose and mouth must be received on cloths which should be immediately immersed in phenol solution (six ounces (180.0) of pure phenol added to one gallon (4 liters) of hot water and diluted with an equal quantity of water). All handkerchiefs, towels, bed linen, clothing, etc., that have come in contact with the patient, after use must be at once immersed, without removal from the room, in the

above solution. These should be soaked for two or three hours and then boiled in water for one hour.

The greatest care should be taken in making applications to the throat and nose lest the discharges be coughed into the face or upon the clothing of the attendant. A pane of glass held between the patient and the physician will effectually prevent this accident.

The hands of the attendant should always be disinfected by washing in the phenol solution and in soapsuds after making applications and before eating.

Surfaces of any kind soiled by discharges should be immediately flooded with phenol solution.

All utensils used by the patient must be kept for his use alone and must not be removed from the room, but must be washed in the phenol solution and in hot soapsuds. After use the soapsuds should be thrown in the water-closet and the vessel which contained it washed in the phenol solution.

The sick-room should be thoroughly aired two or three times a day and should be swept frequently, after scattering wet sawdust or tea leaves on the floor to prevent the dust from rising. After sweeping, the room should be dusted with damp cloths. The sweepings should be burned and the cloths soaked in the phenol solution.

When the disease is recognized shortly after the beginning of the illness all hangings and unnecessary furniture should be removed from the sick-room.

After recovery, the patient's body and hair should be washed with hot soapsuds, he should be dressed in clean clothes, which have not been in the room during the illness, and taken from the apartment.

The quarantine should last as long as the diphtheria bacilli are found upon the mucous membranes; they may persist for six or eight weeks.

The nurse and physician should wear, while in the sick-room, a gown which covers the clothing completely. This should be kept just outside the apartment and should be sterilized directly after use. If the patient, while the throat is being examined, should cough in the examiner's face, the latter should wash the face and hair in soap and water followed by 1 to 1,000 mercury bichloride solution. The hands must always be sterilized upon leaving the sick-room. The nurse should spray or gargle her throat several times a day with a mild antiseptic, such as Dobell's solution.

It is strongly advisable that the nurse and members of the family, if they have been exposed, should receive an immunizing dose (100 units for a child under the age of one month to 800 units for an adult) of antitoxin, and at the first sign of sore throat a full dose must be given. The effect of an immunizing dose lasts about four weeks and at the close of this period a second dose should be given if there is continued exposure.

After removal of the patient the room and its contents should be properly disinfected and aired.

Treatment. The patient should be immediately isolated, especially if the disease is complicated by pneumonia, in an apartment which should be kept cool (65° F.—18.5° C.) and freely ventilated. If practicable, in hospitals it is always better to assign each patient a separate room than to collect the sufferers in a ward. From the onset of the disease until all possible danger of heart failure is past the patient should be kept in bed. At the beginning of the treatment the bowels should be freely opened by means of fractional doses of calomel to be followed by a saline and regular daily movements should be obtained throughout the course of the disease.

The treatment of diphtheria by antitoxin is attended with such good results and has so few disadvantages and dangers that it should always be employed. *All patients* in whom the symptoms and clinical appearances resemble those of diphtheria should receive the treatment without waiting 24 hours or more to learn the result of a bacteriological examination. By enforcing this rule we may give antitoxin to many patients to whom it is unnecessary but it is better to do this than to allow one individual who is suffering from true diphtheria to wait even a few hours.

The antitoxin of any reputable producer may be used and the technique of its administration is simple. An ordinary hypodermatic syringe or the injection outfit provided by the maker of the serum may be used. The needle should be sterilized and the skin of the selected site, which is usually the thigh, buttock or side of the chest, bathed with soap and hot water, washed with alcohol and 1 to 5,000 mercury bichloride solution. The serum should then be slowly injected, the needle withdrawn and the puncture covered with a bit of sterile gauze held in place by adhesive plaster.

The quantity of the antitoxin administered depends upon the severity of the infection and the age of the patient. After the first injection the dosage should be regulated by the effect produced and is limited by this consideration alone. The most concentrated serum obtainable should be used so that the bulk of the dose should be as small as possible. In mild cases one dose of 2,000 to 3,000 units is often sufficient, a unit being the amount required to neutralize the amount of diphtheria toxin necessary to kill 100 small guinea pigs; 5,000 units is a proper initial dose for a child of two years with a severe infection. All cases with laryngeal involvement should receive a dose at least as large. Late in the disease, when the condition is profoundly toxic, 10,000 units may be given and repeated until the condition is ameliorated. Too great insistence cannot be laid upon the importance of giving large doses in severe infections for it is possible by this means to save seemingly hopeless cases. The treatment is harmless and amounts of over 100,000 units have been given. The favorable action of the antitoxin is evidenced as a rule within 24 hours and often within less time. The membrane ceases to spread and becomes softer and more easily detachable. The surrounding and underlying

mucous membrane rapidly assumes a normal appearance. In nasal and laryngeal diphtheria the amelioration of the local inflammation is quite as evident. The glandular swellings diminish and at the same time the constitutional symptoms clear, the temperature falling, the heart action becoming stronger and the prostration less marked.

It is important to keep in mind the fact that the antitoxin, in order to exert its best effect, must be given early. One should not wait for an assured bacteriological diagnosis but the treatment should be instituted as soon as the patient is seen. The serum is impotent to check such complications as septic infection, nephritis and broncho-pneumonia.

Unfavorable Effects of Antitoxin. Authentic instances of sudden death have never been reported and the consensus of opinion is that the treatment is harmless. Various skin eruptions, especially urticaria, may follow injection and instances of arthritis and abscess have been reported. The latter are not often seen and, considering the advantages of the antitoxin treatment, are wholly negligible.

Local treatment has become less important since the introduction of antitoxin but still holds a considerable place in the management of diphtheria. The object sought is cleanliness rather than the destruction of the bacilli. In many instances it is difficult of accomplishment owing to the objections of the patient. If the child is prone to struggle it is better not to employ force, and in such patients the local treatment may be omitted. The most approved method is to irrigate the nose and pharynx with mild solutions, such as normal sodium chloride or weak boric acid, as hot as the patient will bear, by means of a fountain syringe or rubber hand syringe to which a soft rubber catheter is attached. The child should lie on his side with the head slightly lower than the rest of the body so that the irrigation can readily flow from the mouth into a convenient receptacle. In severe infections such irrigations should be given every two or three hours.

Nasal syringing is necessary in patients with nasal discharge and, in those with pronounced symptoms and evident marked nasal involvement, is absolutely necessary. If there is epistaxis the irrigations should be temporarily omitted and sprays of suprarenal extract, 10 percent. calcium chloride solution or of weak alum solution may be employed.

In mild infections, when practicable, mild antiseptic alkaline sprays should be used both upon the nose and pharynx. Dobell's solution or diluted liquor antisepticus (U.S.P.) are applicable for this purpose.

Direct applications to the site of the inflammation are used less now than formerly but many physicians approve them. The patient should be warmly wrapped and held by the nurse, the mouth being held open by a cork between the teeth or by a mouth gag, while the application is made by means of a cotton swab or a brush. Various solutions may be employed, that originated by

Löffler being one of the most efficient. It consists of 10 parts of menthol, 26 parts of toluol, liquor ferri sesquichlorati 4 parts and absolute alcohol 60 parts. Other solutions which may be used are 10 percent. lactic acid; one part of mercury bichloride to 1,000 parts normal sodium chloride; mercury bichloride 1 part, tartaric acid 5 parts, water 1,000 parts; phenol 3 parts, rectified oil of turpentine 40 parts; absolute alcohol 60 parts; hydrogen dioxide solution, etc. Such applications may be made to the inflamed surface every three to six hours.

Insufflations of various powders such as bismuth subgallate, thymol iodide (aristol), nosophen, 1 part iodoform to 5 parts sodium bicarbonate may be given, but the disease can be managed very satisfactorily without this form of treatment.

External applications to the throat in the form of poultices are not indicated. Ice bags, however, may lessen both the pharyngeal inflammation and the tendency to enlargement of the cervical and submaxillary glands. Sucking bits of ice often makes the patient more comfortable and may influence the pharyngeal inflammation. In glandular enlargement and tendency to cervical suppuration inunctions of unguentum Credé and injections of antistreptococcus serum are valuable since suppuration in diphtheria is considered to be due to mixed infection with pyogenic micro-organisms.

In the early stages, and especially in laryngeal diphtheria, steam inhalations by means of a croup kettle, the spout of which is introduced under a tent of blankets constructed over the child's crib, are indicated. The steam may be that from plain water, lime water, 2½ percent. lactic acid solution, 3 percent. phenol solution, one drachm of eucalyptol or benzoinol to a pint of water, etc.

In laryngeal diphtheria with obstruction and pronounced dyspnœa emetics should be given. Here syrup of ipecac may be administered in teaspoonful doses to a child of three years every 15 to 30 minutes until emesis is induced, or a teaspoonful of the following formula may be given in the same way. ℞ pulveris ipecacuanhæ, gr. xxii ss (1.5); antimonii et potassii tartratis, gr. i (0.065); syrupi scillæ, ℥i (30.0); aquæ destillatæ, ℥iv (120.0).

Laryngeal obstruction which does not yield quickly to this form of treatment necessitates immediate intubation or tracheotomy.

The internal administration of drugs with the hope of influencing the course of the disease is considered by many authorities quite useless while among the more conservative the old idea still prevails and drug medication is prescribed as before the introduction of antitoxin. Mercury bichloride is given to adults in doses of $\frac{1}{48}$ to $\frac{1}{12}$ of a grain (0.0012 to 0.005) every two hours with potassium chlorate and tincture of iron chloride, in the hope of causing the membrane to loosen. For children the dosage should be somewhat lower. Toxic effects are not likely to occur since digestive disturbances usually appear before any harm is done. Calomel is also given with

the same object in view, in fractional doses, $\frac{1}{6}$ to $\frac{1}{8}$ of a grain (0.011 to 0.008) every hour, until free diarrhœa is induced.

The saturated solution of potassium chlorate was for long the classical mouth wash in diphtheria and is still prescribed by some but it is in no way preferable to the solutions previously suggested. Gargling with potassium chlorate solution is inferior to irrigating and spraying, for it is almost impossible to bring the gargle into contact with the seat of the inflammation if it is behind the pillars of the fauces. Iron and quinine may be given through the course of the disease in the hope of supporting the patient's strength.

Stimulation becomes necessary as soon as the toxæmia is evidenced by the general condition and by tendency to heart weakness. In mild infections stimulants may be unnecessary but most patients will require alcohol sooner or later. The need of its exhibition is shown by marked constitutional symptoms and feebleness of the pulse. The dosage should be regulated by the patient's condition and either brandy or whiskey, diluted with water, may be given. Half a drachm (2.0) every three hours is a proper amount for a child of five years. This quantity may be increased as necessary. Strychnine is valuable and digitalis may be given in small doses if there is low arterial tension combined with cardiac weakness. Sudden heart weakness necessitates the administration of stimulants hypodermatically and here we may give camphor dissolved in æther or in sterile oil. Hypodermatic injections of morphine in appropriate doses are said to be our best means of combating the cardiac paralysis which is so much to be dreaded in diphtheria.

When there is evidence of obstruction to respiration, due to excessive formation of membrane in the larynx, intubation or tracheotomy becomes necessary. The former procedure possesses the following advantages: It is safe, rapid and without danger, is free from shock, needs no anæsthesia, no wound is made, the patients make no objection and the air taken into the lungs is warmed and filtered by its passage through the upper air passages. Intubation relieves the mechanical obstruction and the indication for its performance is dyspnœa which necessitates relief. Cyanosis is not a safe guide. When there is evident effort in respiration as shown by the action of the abdominal, thoracic and cervical muscles, weak heart action and coldness of the extremities, constitutional depression and evidence of marked toxæmia, intubation should be performed at once. It is far better to intubate too early than to wait until too late. In a few instances the laryngeal membrane may be pushed into the trachea by the introduction of the tube but if the latter is withdrawn immediately the former will be coughed up; if this does not take place tracheotomy must be done at once. The operation of intubation is not difficult and a moderate amount of practice upon the cadaver or upon dogs will render the physician proficient. O'Dwyer's original tube is best, but while he was accustomed to intubate with the patient in the erect position, the

horizontal is preferable, especially if there is tendency to marked prostration or cardiac weakness.

Diphtheritic paralysis should be treated by rest in bed and, if persistent, by means of strychnine, electricity, massage and hydrotherapeutic measures.

During convalescence the patient should be kept in bed until all danger of heart failure is past, this complication being prone to occur for some time after the acuity of the disease is over.

The diet should be fluid and it is very important that the patient should get sufficient nourishment. If nursing, the child should not be allowed the breast but should be fed upon milk withdrawn by means of the breast pump. For older children dilute cow's milk, if necessary peptonized, should be the chief food. If is often necessary, in order that the child shall receive plenty of food, especially in the later stages of the disease, when the appetite is insufficient and there is pain and difficulty in swallowing, to feed the patient by means of the stomach or nasal tube. The latter is especially to be employed in children who object to the former and in those who have been subjected to intubation or tracheotomy. The food should be predigested in so far as is possible. The operation is performed with the patient upon his back and the stomach should be washed before each feeding. Medicines may also be administered by means of the tube. Each feeding should be of considerable size for of necessity the operation cannot be performed at frequent intervals.

The quarantine should be continued until cultures from the throat show the presence of no diphtheria bacilli. The treatment of *diphtheroid infections* (pseudo-diphtheria) is the same as for true diphtheria, save that antitoxin is not indicated. Antistreptococcus serum may be given in its stead.

MUMPS.

Synonym. Epidemic Parotitis.

Definition. An acute infectious disease characterized by inflammation of one or both parotid glands, sometimes extending to the submaxillary glands and rarely to the testicles, ovaries and mammary glands.

Ætiology. This disease is most common in childhood and youth and is most likely to occur in the spring and fall. The infection is uncommon in young infants and in adults and attacks boys more frequently than girls. Sporadic instances of mumps are generally present in cities and epidemics occur at intervals. The disease is communicable from person to person but the specific cause of the contagion is not known; one attack usually confers immunity.

Pathology. The morbid anatomy of this disease consists of a congestion and œdema of the salivary glands with swelling of the walls of their ducts resulting in obstruction of their lumen.

Symptoms. The incubation period is from two to three weeks. Pro-

dromal symptoms are rare and in mild infections the initial symptoms are referable to the affected gland. In the severer types there may be such symptoms at the invasion of the infection as headache, general bodily pains, loss of appetite, vomiting and a rise of temperature, in mild instances rarely above 101° F. (38.3° C.), but in the severe forms the fever may reach 103° to 104° F. (39.5° to 40° C.). The first local symptom is usually pain below and in front of the ear, pain in swallowing is often present and swelling soon becomes apparent in both parotid glands simultaneously or more often in one, the other becoming involved two or three days later or not at all. The swelling is in front of and below the ear and may affect the entire neck in this vicinity. The lobe of the ear is everted and occupies the central part of the tumor. The swelling reaches its greatest size in from two to three days and at this time the pain may be severe and the difficulty in swallowing marked, opening the mouth and mastication may be well-nigh impossible, the secretion of saliva is diminished, and there may be earache.

The disease is usually mild but in rare instances disturbing and even dangerous symptoms, such as delirium resulting from pressure upon the veins of the neck and consequent cerebral congestion, may occur. Suppuration of the glands is rare.

The fever lasts four or five days but the swelling may last a week or more. The opposite side may become involved after the original site of the disease has returned to normal.

Complications are rare in young children but in youths orchitis may occur after the inflammation of the parotids has subsided. The body of the testic e is affected rather than the epididymis and both organs may be involved. The onset of this complication is marked by a rise in temperature, the testicle is swollen, painful and tender; the acuity of the inflammation lasts several days but the swelling persists for a few weeks and rarely atrophy may result. Hydrocele of the tunica, œdema of the scrotum and a muco-purulent urethral discharge may accompany the orchitis.

Ovaritis, and inflammation of the vulva and of the mammary glands may occur in girls.

Still rarer complications are nephritis, otitis media and deafness, pneumonia, pericarditis, endocarditis, meningitis and facial paralysis. Enlargement of the thyroid gland and symptoms suggestive of pancreatic inflammation have been observed. Following the disease, permanent hypertrophy of the parotid may be noted.

The diagnosis is usually easy. Mumps is most likely to be mistaken for acute cervical lymphangitis but may be differentiated by the characteristic shape of the parotid tumor and by the elevation of the lobe of the ear.

The prognosis is very favorable, especially in the absence of complications.

Treatment. Isolation is necessary in institutions and in families where

there are other children, and the quarantine should be continued for at least three weeks. At the onset of the disease the patient's bowels should be opened and if there is fever he should be put to bed and kept there until all constitutional symptoms have disappeared. Avoidance of exposure will diminish the liability to complications. The pain in the swollen gland may be diminished by compresses of gauze impregnated with a mixture of fluid extract of belladonna, ♏ xx (1.33) and an ounce (30.0) of glycerin, with a 5 percent. ointment of ichthyol or a 2 percent. morphine ointment. The compress should be covered with rubber tissue or oiled-silk. Cold compresses may be grateful to the patient but the application of heat is usually preferred. Should the fever give rise to anxiety an ice coil may be applied to the precordium but this will seldom be found necessary. Other symptoms should be treated as they arise.

If enlargement and hardness of the parotid persists after the acuity of the infection has subsided, inunctions of 6 percent. iodine-vasogen or of a potassium iodide ointment are suggested.

The orchitis necessitates rest in bed, support of the testicles by means of a bridge across the thighs made of a strip of adhesive plaster and the application of a 10 percent. ointment of ichthyol.

The dryness of the mouth should be relieved by washes of dilute liquor antisepticus.

The diet should be fluid while the temperature is elevated and even if this symptom is absent it may be impossible for the patient to take solids because of the pain upon mastication and deglutition.

WHOOPING COUGH.

Synonym. Pertussis.

Definition. A specific infectious disease characterized by catarrhal inflammation of the air passages and by paroxysms of coughing accompanied by long inspirations producing the typical "whoop."

Ætiology. This disease is endemic in cities and from time to time epidemics appear, especially in the winter and spring and often associated with epidemics of measles or scarlatina. Children are most frequently attacked and the most susceptible period is between the first and second dentitions. Nursing infants and adults may, however, contract the infection and in old persons it is likely to be serious. Delicate children and those prone to catarrhal affections are particularly liable to infection. Whooping cough is most contagious during the catarrhal stage and is generally spread by direct contact but schools, dwellings, etc., may be infected.

Various observers have described micro-organisms which they consider responsible for the occurrence of the disease but their claims have not as yet been substantiated.

Immunity is usually conferred by one attack, and, while certain individuals seem unable to contract the affection, it must not be forgotten that the disease may occur in a mild form which may be overlooked.

Pathology. There is no constant morbid change associated with whooping cough. Complications are usually responsible for fatalities and here we find the causative lesions such as broncho-pneumonia, bronchitis, collapse of the lung, vesicular and interstitial emphysema and enlargement of the tracheal and bronchial lymph nodes. After death during a paroxysm the brain is found in a state of congestion and punctate or larger hæmorrhages may be present.

Symptoms. After a period of incubation of from 7 to 10 days the first or catarrhal stage sets in. This is marked by slight rise in temperature, running at the nose, conjunctival injection, sore throat and cough, usually dry, and at times paroxysmal. The characteristic whoop may be present from the onset but more commonly after a week or 10 days of atypical cough the tendency to the whoop becomes gradually more marked, the spasms are more and more frequent and the paroxysmal stage begins. A typical fit of coughing begins with 15 to 20 short expiratory coughs between which there is no effort at inspiration. The face is flushed and perhaps cyanotic, the eyes are prominent, there is lacrymation and nasal discharge. At the termination of the paroxysm there is a deep inspiration accompanied by a whoop. Such a fit of coughing may be immediately succeeded by another, be terminated by the expectoration of more or less mucus or followed by emesis. The paroxysms vary in number from four or five daily, to ten times this number. The patient recognizes the imminence of the coughing fits and endeavors to prevent them. Frequent vomiting may render the child emaciated as a result of its inability to retain sufficient nourishment. An ulcer due to friction against the lower incisors, may form at the frænum of the tongue; rupture of a nasal or conjunctival vessel and involuntary urination may occur during a paroxysm.

Physical examination of the thorax during the spasm reveals diminished pulmonary resonance during the expiratory coughs and normal resonance during the inspiration. During the whoop there may be absence of the normal vesicular murmur on account of the slowness with which air enters the lungs. Mucous râles may be present.

The attacks of coughing may be induced by emotion, irritating inhalations and even by deglutition. The paroxysmal stage of the disease lasts from one month to six weeks, increasing in intensity for the first half of this period, then remaining stationary for about a week and then gradually subsiding. The paroxysms are very likely to recur if the patient catches cold or if his digestion becomes disordered. This reappearance of the whoop is not to be considered a true relapse.

The stage of convalescence lasts from three to four weeks but may be much longer than this period.

Complications are frequent and sometimes serious. The congestion caused by the paroxysm may cause bleeding from the nose, conjunctiva or even the ears, as well as petechial hæmorrhages into the skin, hæmoptysis and intestinal hæmorrhage. Intracranial extravasations of blood may occur, causing death, various paralyses or convulsions. These hæmorrhages are seldom large and their manifestations are rarely permanent. Disturbances of the special senses are sometimes noted.

Pulmonary complications are usually responsible when death takes place. Both broncho- and lobar pneumonia may be observed. Inflammation of the larger bronchi is the rule and is not especially to be feared; involvement of the small tubes is as serious as broncho-pneumonia. Transient vesicular emphysema is not uncommon, being caused by the severity of the paroxysm; interstitial and even subcutaneous emphysema have been observed. Enlargement of the bronchial glands is common.

Infants suffering from pertussis in summer are very frequently affected with diarrhœa. Malnutrition may result from the frequent emesis caused by the paroxysms.

Albuminuria and glycosuria may occur but these conditions are usually only temporary. Overstrain of the heart may result in permanent valvular endocarditis and, as sequelæ, hernia, prolapsus ani and a predisposition to tuberculosis may be mentioned.

The diagnosis in typical instances may be easily made; others may occur, in which there is no whoop; here the problem is much more difficult, but a cough, occurring chiefly at night, which increases in severity for two or three weeks, is unaccompanied by constitutional symptoms and physical signs and which may manifest itself in paroxysms followed by vomiting, is probably pertussis. In the presence of epidemics the diagnosis is greatly simplified. An increase in the number of leucocytes, particularly of the lymphocytes, is an important feature of this disease.

The prognosis is distinctly bad in children under four years of age and in those previously delicate, broncho-pneumonia being responsible for many of the deaths.

Treatment. The patient should be kept from association with other children; confinement to a single room is unnecessary, consequently all individuals to whom the infection is prejudicial should be sent away. Particularly should all delicate children and those with any tuberculous tendency be kept from exposure. Quarantine is necessary until the paroxysmal stage is past.

In the treatment of the disease itself hygienic measures are most important.

The patient should, as a rule, be kept in the open air, especially during the warm months. Older children may be allowed out of doors on pleasant days even in winter. Delicate children, however, and those in whom there is any tendency to bronchitis should be kept in doors. Special stress should be laid upon the thorough and frequent ventilation of the apartments occupied by the patient and frequent, even daily, fumigation by means of a formaline candle or lamp. The bedding, clothing, etc., should be often changed.

In protracted instances a change of climate is indicated and delicate children do better, especially in winter, if they are taken to a warm place. The sea shore and sea voyages are often beneficial.

Internal Treatment. Of the almost numberless drugs which have been recommended in whooping cough bromoform is, perhaps, one of the most effectual but must be employed with great caution as cases of poisoning have been reported from its use. It may be administered in the following formula: Bromoform, 1 part; alcohol, 8 parts; glycerin, 48 parts; compound tincture of cardamom, 8 parts. Each drachm (4.0) contains 3 minims (0.2) of bromoform which may be given to a child of two years, three or four times daily. The mixture should be carefully made and must be shaken immediately before taking. Bromoform may also be taken dropped upon lumps of sugar.

Antipyrine is a useful drug but should not be given if heart or severe pulmonary complications are present. Its dosage for a two year old child is two grains (0.13) 5 or 6 times a day. In cases with particularly marked paroxysms antipyrine may be advantageously combined with sodium bromide or heroine.

Quinine has enjoyed much vogue in the treatment of pertussis. Its dosage for a child of two years should be about three grains (0.2) three times a day; it may be given either as the sulphate or the hydrochloride. It is important that it should be prescribed in palatable form, for instance, in chocolate covered tablets. Its great disadvantage is its liability to disturb the stomach in infants and young children; this fault may be obviated by giving the drug in enemata or in suppositories. The treatment should begin early and it may be wise to give each dose directly after a fit of coughing since at this time it is less likely to cause gastric disturbance.

Aristochine (quinine carbonic ester) has no bitter taste and may be employed instead of quinine. Its dose is 1½ to 3 grains (0.1 to 0.2) three times a day. Euquinine is another substitute for quinine.

In belladonna we have an effectual means of diminishing the number and severity of the paroxysms. The beginning dose should be small and gradually increased until physiological effects are produced. Its action must be carefully observed for the evidence of toxic symptoms. A two year old child may receive of the fluidextract ¼ to ½ a drop (0.016 to 0.032) every four hours; atropine in doses of $\frac{1}{400}$ of a grain (0.00015) may be substituted. The

above doses may be gradually increased in size or given at gradually diminished intervals until their physiological effect as evidenced by an erythema of the skin is noted.

Camphor is said to act, not only as a stimulant in the bronchitis and pneumonia of pertussis, but also upon the disease itself. It may be given internally in appropriate doses.

The severity of the nocturnal attacks may be lessened by sodium bromide 2 to 4 grains (0.13 to 0.24), or by codeine, sulphonethylmethane or hydrated chloral; the latter, however, must be given with care. Certain clinicians rely chiefly upon paregoric to check the paroxysms.

In general it may be said of the drug treatment of whooping cough, that since the disease is self-limited and since in all probability its course cannot be shortened, internal medication, in patients whose paroxysms are neither distressing nor frequent, should be postponed until the cough becomes so marked as to interfere with rest and the bodily functions. When this event takes place medication is indicated.

Local treatment by means of sprays, inhalations, insufflations of various powders and by direct applications to the larynx may be prescribed. Sprays and insufflations probably influence the disease but little, but may be useful in allaying the catarrhal symptoms in the upper air passages. As sprays a solution of one of the more soluble quinine salts, Dobell's solution, liquor antisepticus, or a mixture containing menthol 0.3 parts, thymol iodide 1 part, oil of sweet almonds 25 parts may be used. Insufflations such as the following may be employed: Benzoic acid and bismuth subsalicylate each 10 parts, quinine sulphate 2 parts, or powdered antipyrine and quinine hydrochloride each 1 part, boric acid 2 parts, bismuth subnitrate 5 parts. Direct applications of 5 percent. cocaine solution may be made to the larynx in older children, but with caution. One percent. solutions of phenol or of resorcinol are less dangerous. The applications of a 1 to 2 percent. solution of formalin to the pharynx has been advised. Inhalations, to be given by impregnating the air of the apartment with various mixtures or by means of an inhaler, are sometimes beneficial. By this means we may lessen the irritation of the air passages and combat the tendency to bronchitis. The following formulæ are applicable: Æther, chloroform and creosote equal parts; to be used upon the cotton or sponge of a respirator. Phenol, 3 parts, thymol, 5 parts, alcohol, 50 parts, compound tincture of lavender, 20 parts, water to 1000 parts; to be evaporated over an alcohol lamp.

Inhalations of ethyl iodide are said to afford instant relief to the paroxysms and to lessen the severity of the disease.

The spasm of the glottis, which may occur when the spasms of coughing are frequent and severe, may be relieved by means of laryngeal intubation. The tube may remain in place as long as the paroxysms continue.

For the convulsions a few whiffs of chloroform may be given and as an antispasmodic a plaster of asafœtida applied to the whole chest has been suggested.

A 20 percent. solution of cypress oil in alcohol sprinkled upon the patient's pillow, the upper part of the bed and upon the underclothing several times daily is said to benefit the cough.

Lewriaux has produced an antitoxic serum by inoculating horses with cultures of a bacillus which he has isolated from cases of whooping cough. In his hands injections of from 75 to 150 minims (5.0 to 10.0) of this serum, especially if given early in the disease, have acted favorably.

The tendency to vomiting may be lessened by applying an abdominal band to which a snugly fitting elastic bandage has been sewn. To young children, in whom this symptom is marked, a few drops of the camphorated tincture of opium or a half teaspoonful (2.0) of a mixture of dilute hydrochloric acid 2 parts, simple syrup 200 parts, lemon spirit 2 parts, may be given.

The sublingual ulcer should be kept clean by the use of mild antiseptic mouth washes and may be touched from time to time with a 3 percent. solution of silver nitrate. Heart weakness calls for the administration of alcohol and strychnine.

The complicating pneumonia, bronchitis, etc., may be treated as ordinarily.

Throughout the disease the bowels should be kept freely open and the patient should be most carefully fed. The regulation of the diet is often a difficult matter since vomiting is so likely to occur, but is most important, for digestive disturbances accentuate the severity of the whooping cough and increase the frequency of the paroxysms. Young infants should be given diluted milk which may if necessary be peptonized. Older children should be allowed only fluids, chiefly milk, during the acuity of the disease. It is essential that the patient's nourishment be thoroughly maintained, consequently vomited meals should be repeated.

During convalescence the administration of tonics, especially codliver oil, the syrup of iron iodide and arsenic, is usually necessary since, even if the infection has run a seemingly uncomplicated course, the patient's system is depreciated and his powers of resistance are decreased, owing to the strain to which he has been subjected.

CEREBROSPINAL FEVER.

Synonyms. Epidemic Cerebrospinal Meningitis; Malignant Purpuric Fever; Petechial Fever; Spotted Fever.

Definition. An acute infectious febrile disease occurring sporadically and in epidemics and characterized by inflammation of the membranes of the brain and spinal cord and frequently by an eruption upon the skin.

Ætiology. Epidemics of this disease have occurred from time to time in the United States, the last being in New York City during the winter of 1904–5. The epidemics are usually localized and seem to occur rather more often in the country than in cities and usually in the winter and spring. Unsanitary conditions, fatigue, mental and physical depression and the association of large numbers of persons in small spaces, such as army camps and barracks, predispose to the occurrence of the disease.

The specific cause of epidemic meningitis is the *diplococcus intracellularis meningitidis* which is found within the bodies of the polynuclear leucocytes of the inflammatory exudate. With this micro-organism other bacteria, such as the staphylococcus, the streptococcus, the pneumococcus, the bacillus coli, etc., may be associated.

Cerebrospinal fever is probably not directly contagious in that the infection is transmitted by fomites and the excretions and it is difficult to trace the origin of a certain instance of the disease to any other, irregular distribution being a characteristic of the affection. The contagium is, however, supposed to be air borne and to reach the meninges through the nose by means of the cribriform plate of the ethmoid bone.

Pathology. The skin may bear the remains of the petechial or herpetic eruption in certain instances but the changes in the nervous system are more constant. These, however, are very variable in degree and may occur as merely slight congestion or as pronounced hyperæmia of the pia-arachnoid, with fibrino-purulent deposits, especially at the base of the cerebrum, resulting in a coating of the meninges with the exudate. The upper and lateral surfaces of the brain may also be involved in the inflammatory process. The exudate is beneath the pia mater and is likely to be more profuse in the longitudinal fissures and Sylvian fissures. The substance of the brain may be congested and even softened. In the infections of long standing the meninges are thickened and adherent to the cortex. The ventricles are filled with sero-pus and in prolonged instances of the disease may be greatly distended, their walls being softened; here a condition of hydrocephalus may sometimes be met.

The cranial nerves, especially the optic, the facial and the auditory, are often involved.

The spinal meninges are involved similarly to those of the brain. The exudate is most profuse upon their dorsal surfaces and the lower segments are chiefly affected. The spinal and the central canal may both contain pus in considerable amount. The cord itself may be inflamed and the spinal nerve roots may be the seat of a neuritis or may be compressed by the exudate.

Microscopical examination shows the exudate to consist of polynuclear leucocytes enmeshed in fibrin. The meningococci are found both within the leucocytes and amongst the fibrin. The substance of the brain and cord

may be infiltrated with pus, the neuroglia cells are swollen and hæmorrhagic foci may be present.

The lungs may be the seat of a pneumonia caused by the diplococcus pneumoniæ or by the meningococcus. Pulmonary congestion or pleurisy may be observed.

Endocarditis sometimes is noted and the congestion of the various viscera occurring as a result of an infectious disease is usually present. The spleen may be enlarged.

Symptoms. These vary with the type of the disease. The incubation period of the *ordinary form* is not known. Its onset is usually sudden, although there may be a short prodromal period marked by dizziness, headache and pain in the back. The invasion is often evidenced by a chill and vomiting of the projectile type followed by headache, pain in the back of the neck and in the lumbar region. These symptoms may be mild or very severe. The muscles of the neck are stiff and movement causes an increase of the pain. The temperature is not characteristic, it may not exceed 102° F. (38.9° C.) but in marked infections it may reach 104° to 106° F. (40° to 41.1° C.) and may ascend even higher just before death. Remissions are not infrequent. The pulse in adults is at first not very rapid and is of good strength. Later it becomes faster and weaker. In children it is usually rapid from the outset. In certain instances the disease is characterized by a pulse of not over 60 or 70. In the absence of pulmonary complications the respirations are not much accelerated. Cheyne-Stokes respiration is sometimes observed.

The symptoms due to the nervous system are marked and of early appearance. The skin is hyperæsthetic and the muscular rigidity increases as the disease progresses, spasm of the neck muscles draws the head back and opisthotonos may be present; clonic spasms may occur, especially in children, in whom the onset may be marked by a convulsion. Strabismus, nystagmus and facial contractions are common. As the exudate increases the symptoms of pressure paralysis succeed those of irritation and there are paralyses of the muscles of the face with ptosis, pupillary inequality and rarely paralysis of the muscles of the body and limbs. Of symptoms referable to the special senses photophobia, diplopia and auditory disturbances, especially intolerance of sound, are often present.

Delirium is an early symptom and may be violent. The increase in intracranial pressure later results in stupor and finally in coma.

The skin manifestations are important although the eruption is by no means constantly present. Herpes labialis is very frequent and herpetic eruptions may appear elsewhere upon the face as well as upon the body and limbs. The characteristic rash of the disease is petechial and often general. The number of spots varies greatly, in some instances only a few being noted, while in others they are very numerous. They do not disappear on pressure.

Other rashes such as erythema, urticaria, ecthyma, erythema nodosum, pemphigus, and spots resembling those of enteric fever, may occur. Cutaneous gangrene has been noted.

The tongue is at first moist and coated, later it may become dry; distressing vomiting may persist throughout the disease. The bowels are usually constipated but at times a diarrhœa may be present at the invasion.

The urine is usually scanty, high colored and contains albumin. At times it is increased in quantity and contains glucose as a result of the pressure of the exudate upon the cerebral centers.

Leucocytosis is a constant symptom and is often persistent.

Kernig's sign is constantly present here as in all other conditions in which there is inflammation of the spinal meninges. It is obtained by placing the patient in a sitting position with the thighs flexed at the hips and the legs partly flexed at the knees. The observer then attempts to extend the leg at the knee; this will be found impossible on account of the resistance of the flexor muscles. If the thigh is not flexed upon the abdomen the leg can be straightened. This phenomenon is explained upon the ground that in meningeal inflammation the spinal nerve roots become irritable and the flexion of the thighs at the hips, when the patient is sitting, tends to stretch the lumbar and sacral roots and increase their irritability.

Babinski's reflex, a turning up of the toes, especially the great toe, consequent upon tickling the sole, is not constant.

The course of cerebrospinal fever is very variable; death may occur within a few hours or the disease may be prolonged for months. Fatal instances usually die within the first week. If the patient survives for five or more days improvement may be expected, the temperature falls, the nervous symptoms gradually clear and convalescence becomes established. This period is usually long. Relapses are not uncommon.

The malignant form of the disease is very sudden in its invasion and while there may be only slight rise in temperature the headache and nervous symptoms are pronounced, collapse with feeble and slow pulse and labored respiration ensues, to be followed by death, sometimes within 24 hours. A hæmorrhagic eruption is usually present. Such infections are often seen at the beginning of an epidemic.

A mild form of the disease sometimes occurs in which the presence of an epidemic gives the only clue to diagnosis.

The abortive form is evidenced by pronounced and severe symptoms at its onset; these cease suddenly and an early convalescence is established.

The intermittent form is characterized by a temperature resembling that of pyæmia and which exhibits remissions daily or every other day.

The chronic form. This designation is applied to a type of the disease in which the course may be prolonged for several months. The patient suf-

fers from headache, digestive irritability, marked emaciation and exhaustion, and remissions of the fever.

Complications. Of these pneumonia is one of the most frequent and it may be difficult to determine whether it or the meningeal inflammation is the primary disease. In the presence of an epidemic the problem is more simple than at other times, and when the headache, pain and stiffness in the back, and nervous symptoms precede other manifestations, the chances are in favor of meningitis. Pleurisy, bronchitis, endocarditis and parotid inflammation may occur. Arthritis is a common complication in certain epidemics. The affection is usually multiple and the effusion may be either serous or purulent.

The sequelæ of cerebrospinal fever are numerous and often serious. Those referable to the motor nervous system are facial palsy of varying extent and paralyses of the limbs; these may be permanent but are usually temporary only. Sequelæ referable to the organs of special sense are optic neuritis resulting in blindness, choroido-iritis and keratitis; labyrinthine inflammation resulting in deafness, otitis media and its complications. Speech disturbances may occur and obstinate headache and muscular pains have been noted. Chronic hydrocephalus, abscess of the brain and mental weakness have deen observed.

The diagnosis during epidemics is usually not difficult but the recognition of sporadic cases, especially those of atypical course, is sometimes far from easy. The diagnostic symptoms which are present early in the disease are the headache, stiffness, with retraction of the head, of the muscles of the neck and back, tremors and mental disturbance, especially delirium. Pneumonia may be mistaken for meningitis but here we have a diminution of the urinary chlorides, an absence of Kernig's sign, a rapid pulse and a preponderance of the pulmonary symptoms over those referable to the nervous system. With regard to the general differentiation of this disease, the presence of Kernig's sign is an important point and the result of lumbar puncture should usually confirm or disprove the diagnosis. This operation is simple, harmless and needs no anæsthesia beyond that obtainable by means of the ethyl chloride or æther spray, or at most a few breaths of chloroform. The patient should lie upon the right side with knees drawn up and the left shoulder turned toward the front. An aspirating syringe is used, the needle of which is introduced one centimeter to one side of the median line and midway between the third and fourth or the fourth and fifth lumbar vertebræ below the spinous process, the thumb being placed as a guide between the spinous processes. The needle should be directed slightly upward and inward, and at a depth of about two centimeters in infants and from four to six in adults, should enter the canal. The syringe now being detached from the needle the fluid is allowed to flow into a sterile test tube. From 1½ to 4 drachms (6.0 to 16.0) are neces-

sary for chemical, microscopical and bacteriological examination. The fluid in epidemic meningitis is usually turbid and may contain pus or blood; that in tuberculous meningitis is clear in most instances. The meningococcus is often present in the fluid of epidemic meningitis in considerable numbers.

The prognosis varies in different epidemics from 20 to 75 percent. The mortality is very high in the prolonged cases, in young children and in the aged. The initial symptoms give no index of the probable subsequent course of the disease, and while a mild invasion may be followed by grave symptoms, a severe onset may be succeeded by a rapid amelioration. Convalescence may be interrupted by recrudescences or relapses.

Treatment. Much in the way of prevention may be accomplished by the establishment of proper ventilation, drainage and general sanitation.

In private practice the patient should be isolated, in order to secure the necessary quiet as well as to prevent contagion, in a properly ventilated room which need not be darkened since bandaging the eyes accomplishes the same purpose.

The old method of treatment by blood-letting is seldom employed at present but the pain may be relieved in robust patients by the application of wet cups to the back of the neck; the use of the ice helmet and of ice bags applied along the course of the spinal cord is to be recommended, and while blistering is unnecessary, touching the skin of the nape of the neck with the actual cautery may be beneficial. Elevating the head of the bed often makes the patient more comfortable.

The plan of treatment by means of hot bathing as advocated by Aufrecht is said to accomplish exceedingly good results. A hot bath at 104° F. (40° C.), lasting from 15 to 20 minutes is given once or twice daily or even oftener. An ice bag is applied to the head and stimulants, such as alcohol, ammonia, etc., are given as indicated. While the temperature, muscular rigidity and emesis are not markedly influenced by this treatment, it is asserted that bathing after this fashion relieves the pain, lessens the restlessness and delirium and may restore consciousness. Such complications as endocarditis do not necessitate the intermission of this treatment. It may be safely stated with regard to the hot bath method, that it does no harm, may benefit the patient and may exert a favorable influence upon the course of the infection.

Lumbar puncture, with or without the injection of antiseptic fluids, has been employed in treatment as well as in diagnosis, by many clinicians. The opinions as to its efficacy differ to a marked degree. It may be asserted, however, that, even though the procedure may not be curative, it does relieve the symptoms due to pressure and is worthy of employment for this reason. The technique of the operation has already been described (p. 108). In instances where marked pressure symptoms are present from 5 to 15 drachms (20.0 to 60.0) may be withdrawn and the procedure repeated if necessary.

Where only slight evidence of pressure is manifest not more than 5 to 7½ drachms (20.0 to 30.0) should be withdrawn.

The hot bath treatment and that by lumbar puncture may be employed in connection with one another.

Of the solutions for intraspinal injection, following the withdrawal of fluid by lumbar puncture, 1 percent. lysol is most commonly used. From two to three drachms (8.0 to 12.0) have been injected with varying results in the hands of different clinicians. Mercury oxycyanide solution has also been employed. This form of treatment, while it may do no harm, has, taking everything into consideration, given no very remarkable results.

The fact that there is a marked antagonism between the meningococcus and the Klebs-Löffler bacillus has suggested the employment of diphtheria antitoxin in the treatment of meningitis but unfortunately the results obtained either by hypodermatic or intraspinal injections of antidiphtheritic serum have not been sufficiently good to establish this treatment upon a firm basis.

The subcutaneous injection of mercury bichloride solution along the course of the spinal cord has been recommended by several authors. The adult dose is $\frac{1}{6}$ of a grain (0.01) and that for children from $\frac{1}{120}$ to $\frac{1}{12}$ of a grain (0.0005 to 0.005). The injections are well borne and may be repeated while the temperature, pain and muscular stiffness persist. Angyan, who has reported at length upon this form of treatment, while not asserting that it influences the length of the disease, considers that by its use the symptoms are favorably affected.

With regard to the general management of epidemic cerebrospinal meningitis and the relief of symptoms the following points may be given. The bowels should be kept freely open throughout the disease by means of calomel given in divided doses, by salines or by enemata. The patient should be allowed plenty of water to drink which will increase the elimination of the toxins through the kidneys. In instances of urinary retention the use of the catheter may become necessary.

The nose and throat, which are often inflamed, should be sprayed and irrigated with mild alkaline solutions and the frequent use of a mouth wash will lessen the tendency to dryness of the tongue. In instances where there is dysphagia, feeding by means of the stomach or nasal tube or by rectum should be practised.

For the vomiting the patient should be given bits of cracked ice to suck, cold should be applied to the epigastrium and feeding should be infrequent until this symptom is under control. In obstinate infections the use of morphine hypodermatically may become imperative. Vomiting due to pressure upon the medulla may be relieved by lumbar puncture.

The nervous symptoms necessitate the employment of various analgesics and sedatives. Cool packs and tepid baths, to which mustard may be added,

often, in the milder infections lessen the tendency to sensory, motor and mental excitability and may induce sleep. Antipyrine is often effectual in checking the headache and general hyperæsthesia and is also useful in lowering the temperature and relieving the mental excitability. While not likely to cause cardiac depression, the drug should be given with care. Acetphenetidine may also be employed. When these two drugs fail to control the nervous symptoms we may have recourse to codeine or morphine. The bromides likewise may be administered in this connection. For the convulsions hydrated chloral should be given *per rectum* and inhalations of chloroform may be prescribed. Where these fail hypodermatic injections of morphine should be given.

In the later stages, where cardiac weakness is pronounced, free stimulation by means of alcohol, ammonia and, in cases of collapse, by hypodermatic injections of camphor in oil, are indicated. Heart weakness may also be combated by means of high hot saline irrigations given *per rectum* and by hypodermatoclysis with normal saline solution. The former procedure has the additional advantage of assisting in the elimination of toxins through the kidneys, it being a vigorous diuretic.

Various drugs have enjoyed, probably undeservedly, a vogue in the treatment of this disease. Among them may be mentioned ergot, quinine, physostigma and belladonna.

In chronic types of the disease and in those which are left with meningeal thickenings potassium iodide or the syrup of hydriodic acid should be given with the intent to induce absorption.

The complications and sequelæ should be treated as when occurring as a result of other causes.

The importance of maintaining nutrition cannot be over-rated. During the acute stage the diet should consist of milk, broths, gruels and other fluids; later semi-solids, to be followed by ordinary diet, may be allowed. The use of the stomach tube may be necessary.

ERYSIPELAS.

Synonym. St. Anthony's Fire.

Definition. An acute febrile contagious disease characterized by intense local inflammation of the skin, a remittent temperature and a tendency to spread.

Ætiology. This disease is common, often endemic, and from time to time epidemic. It is most frequent in the spring months and is very likely to break out in old and improperly kept hospitals and institutions; it may occur, however, under the best sanitary conditions. Poor general condition, alcoholism and chronic diseases predispose to its incidence and certain individuals seem especially prone to acquire the infection. One attack does not

confer immunity, on the contrary recurrences are frequent. Women, *post-partum*, and the subjects of recent surgical operations, even such procedures as cupping, leeching and vaccination, are particularly liable to acquire the disease.

The contagium, while not very active, may be transmitted by contact with a third person and by fomites, bedding, furniture, etc. While a solution of the continuity of the skin would seem to be a necessary antecedent to infection, idiopathic cases do occur in which no such manifestation is discoverable; in such, however, it is impossible to state that a microscopical lesion has not existed, although the possibility that the contagium may reach the blood stream by means of the respiratory or the digestive tracts must be considered.

The specific cause of erysipelas is a bacterium, the *streptococcus erysipelatis*, one of the micro-organisms of the *streptococcus pyogenes* group.

Pathology. The inflammatory redness of the skin in erysipelas does not persist *post mortem* but œdema and abscesses or blebs, if they have occurred, are left behind. Microscopic examination reveals the presence of the streptococci in the lymphatics and lymph spaces at the margin of the inflamed area; they may be demonstrated in the lymph vessels of the structures beyond the affected tissues as well. Associated lesions are metastatic abscesses in the various organs and hæmorrhagic infarcts of the lungs, kidneys or spleen. Secondary septic pleurisy, pericarditis or endocarditis may be present. Acute nephritis may be found; meningitis and pneumonia are rare.

Symptoms. The variety of erysipelas which usually confronts the physician is that which occurs without previous discoverable lesion and most often involves the head and face. The incubation period is given by various authorities as being from 1 to 14 days. The onset of the disease is usually marked by one or more chills, malaise and anorexia, followed by a rise of temperature. If the point at which infection has taken place is discoverable it becomes red, a reddened, burning spot appearing usually upon the bridge of the nose or upon the chin. This rapidly increases in size, becoming elevated with a distinctly palpable margin, smooth, brawny, œdematous and hot to the touch. The skin feels tense to the patient and the inflammation spreads rapidly toward the forehead and ears, closing the eyes, thickening the lips and ears and distorting the features. Blebs form upon the ears and eyelids; these contain serum; the neck is rarely involved but the cervical glands are swollen and there is marked leucocytosis. In the severe types deep abscesses may form. The inflammation as it extends gradually diminishes in the parts first affected, lasting about four days in one spot. If its progress becomes limited the temperature falls by crisis and the symptoms disappear. Recurrences are not rare. With the fever the pulse is rapid, there are headache and sometimes cerebral symptoms, the constitutional manifestations being due to the toxæmia resulting from the growth of the bacteria in the organism.

Severe infections, which are not uncommonly met in aged, debilitated and alcoholic patients, are characterized by marked prostration, cerebral symptoms and the appearance of the so-called "typhoid state" in which death may occur.

The mucous membranes of the mouth, pharynx and larynx may be involved by extension from the skin, and laryngeal œdema may ensue. Albuminuria is common and hæmaturia has been observed.

Protracted infections may be met in which the inflammation wanders from one part to another, gradually involving the whole body.

Complications are not common although such conditions as septic inflammations of the pleura, pericardium and endocardium, bronchitis, pneumonia and nephritis do occur.

Meningitis is very rare, septicæmia and pyæmia are more often seen.

The diagnosis is usually easy, the constitutional and local manifestations being quite characteristic.

The prognosis in robust persons is good, the debilitated, those addicted to alcohol, infants with erysipelas due to infection at the umbilicus, and the aged furnishing the great majority of the fatalities.

Treatment. With regard to prophylaxis it may be stated that isolation is a necessity, especially in hospitals. Surgeons and those engaged in obstetrical practice should not attend cases of erysipelas. Frequent baths with boric acid solution (5 percent.) will remove the desquamating epidermis and the bed and body linen should be changed at least once daily.

The patient should be kept in bed upon a liquid diet and the channels of elimination should be kept freely open by means of plenty of fluids to drink and laxatives when necessary. If here is headache and severe general pain such analgesics as antipyrine salicylate, gr. x (0.66) or acétphenetidine, gr. x (0.66) may be prescribed. The cerebral symptoms, if present, may be controlled by cool or tepid sponge baths, by the bromides or by morphine hypodermatically. In feeble patients stimulation by means of alcohol and strychnine may be employed as indicated.

It is doubtful if internal medication can influence the infection in any way but the tincture of iron chloride is prescribed by many in the hope that in some way it may exert a specific action. A drachm (4.0) every three hours may be given but a smaller dose—10 drops (0.66)—will probably do the work quite as well.

Injections of antiseptic solutions into the skin just beyond the margin of the inflammatory area have been practised and seem to have a rational basis for their employment. Two percent. phenol solution or 1-4,000 mercury bichloride solution may be used.

Of local applications that most popular at present is an ointment or solution of ichthyol of 10 percent. strength, applied upon gauze and renewed

several times daily. An ointment containing 1 part of phenol, 10 parts of ichthyol and 20 parts of lanolin is also recommended. Moist dressings of 1 percent. phenol, 1 to 1,000 mercury bichloride, equal parts of ichthyol, glycerin, and water, 1 to 1,000 potassium permanganate, and dusting with equal parts of bismuth benzoate and starch have been suggested.

In the umbilical infection of the new-born, ichthyol in 10 percent. solution or ointment or an ointment of $\frac{1}{20}$ part of mercury bichloride, 10 parts of cerate of lead subacetate and 40 parts of vaseline may be applied.

The use of Credé's ointment may be followed by good results. It should be well rubbed into the skin just beyond the inflammation.

The suggestion to lightly scarify the part before applying moist antiseptic dressings would seem reasonable since by this means the germicide is able to come into closer contact with the infective micro-organisms in the tissues.

Various observers have employed injections of antistreptococcus serum; the results reported have in many instances been favorable and it is quite possible that further experimentation with this treatment may establish it as a routine method. This form of treatment does not seem to shorten the disease but the injection of 5 drachms (20.0) of the serum in one or two doses is said to lessen the severity of the symptoms and to cause a disappearance of the albuminuria.

The diet during the febrile stage should be of fluids only and as highly nutritious as possible in order to maintain the patient's strength and powers of resistance.

During convalescence the dietary should still be carefully regulated and the administration of tonics, such as strychnine, iron and quinine is strongly indicated.

ACUTE ARTICULAR RHEUMATISM.

Synonyms. Rheumatic Fever; Inflammatory Rheumatism; Acute Rheumatism.

Definition. An acute infectious febrile disease characterized by inflammation of one or more of the joints.

Ætiology. The disease is most common during the cold and damp months and in young adults, especially those of low vitality and whose occupations expose them to the inclemencies of weather. Extremes of cold are less likely to predispose to the disease than a moderately low temperature accompanied by moisture. An hereditary tendency to the disease has been noted.

It is probable that the infection is the result of specific bacterial intoxication, although thus far no causative germ has been isolated. Various observers have, however, cultivated from the inflammatory exudates of rheumatic patients different micro-organisms which are capable of causing arthritis

and endocarditis in lower animals. Several distinct species of bacteria have been isolated from rheumatic exudates which fact goes to show, as suggested by Flexner and Barker, that perhaps acute articular rheumatism may be the result of infection of the blood by any one of several species of pathogenic microorganisms at a time when circumstances are such as not to favor the development of general septicæmia but are favorable to the propagation of inflammatory conditions of one or more of the serous membranes.

Various forms of arthritis simulate acute articular rheumatism, such as those complicating other acute infectious diseases, notably scarlatina, and the arthritis due to the gonococcus. These are not true rheumatisms but inflammations of the synovial membranes due to other causes.

Pathology. The affected joint is swollen, hot, sometimes red, and is bathed in acid perspiration.

Its synovial lining is congested and swollen. The joint cavity is sometimes distended by fluid. This is usually serous but may be turbid, or rarely purulent. The cartilages within the joint and covering the articular surfaces may be eroded.

Symptoms. The onset of the disease is usually rapid, one or more joints becoming, even within a few hours, swollen, painful, tender, reddened and bathed in perspiration. Less frequently there is a short period of invasion during which the patient has indefinite pains in bones and joints. The onset is rarely marked by a chill, but is usually followed by a rise in temperature. The regular course of the infection lasts about six weeks but with proper treatment we are usually able to shorten the acute stage to six or seven days. With the inception of the disease there is often nausea and vomiting. The temperature rises to 102°–104° F. (38.9° to 40° C.). The pulse is accelerated (95 to 100), the urine is scanty, high colored and acid with a copious sediment of urates; it may contain albumin; the bowels are usually constipated. The febrile movement continues while the joints are acutely inflamed but frequently is of remittent type.

The skin is usually bathed in an acid perspiration and it may be the seat of various eruptions. These may be erythemata, diffuse papular, tubercular or marginate, urticaria, or a true purpura with hæmorrhagic spots of varying size. Sloughing may follow these last and with them there may be hæmorrhages from the various mucous membranes and hæmaturia. This condition is denominated *peliosis rheumatica* and is of doubtful rheumatic origin. Nodules of various sizes up to that of a pea have been observed in certain patients in the tendons and muscle sheaths of the extremities, limbs and even over the vertebræ. These are a feature of the declining stage of the disease; they are more usually seen in children and remain from several days to several weeks.

The pain is usually very severe, any movement increases it and even the

weight of the bed clothing may cause extreme discomfort. The patient finds that the pain is least when the joints are held in a position of mid-flexion.

Usually more than one joint is inflamed and those most often attacked are the knee, ankle, wrist, elbow, shoulder and hip, in the order named. The joints of the fingers are not exempt. Rarely is a single joint affected, though this may occur. The inflammation has a tendency to involve successively one joint after another, the symptoms in one being to some extent relieved as another is attacked. At times the process will recur in a joint which has partially returned to normal.

A patient who has once suffered from rheumatic fever is prone to recur-

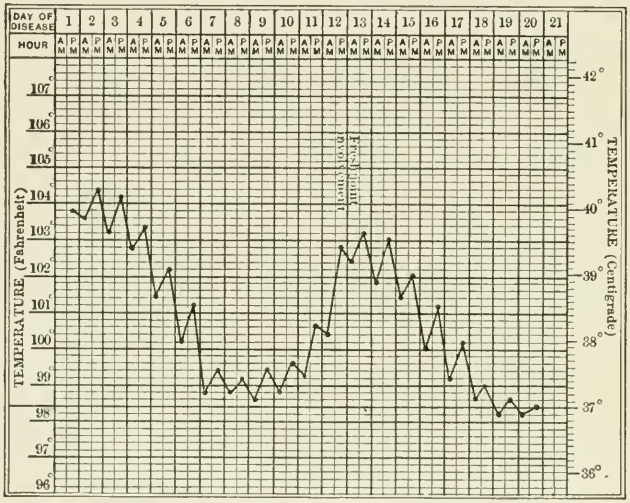

FIG. 6.—Clinical chart of acute articular rheumatism.

rences of the disease at intervals of from one to several years, and it is these successive attacks which are likely to result in serious complications, more especially in the heart.

Hyperpyrexia. In certain patients the temperature may rise to a very high level even to 110° F. (43.3° C.). Such a condition is a very serious one and generally results in death unless the fever can be quickly reduced. With this excessive temperature are other symptoms of marked constitutional disturbance, such as headache, delirium, unconsciousness and heart failure.

Complications. These affect the serous membranes and the endocardium and are the result of the lodgment of the infectious material in the blood in these situations. The pleura, the pericardium and more rarely the peritonæum are the membranes involved and their inflammations are amenable

to anti-rheumatic treatment. In rheumatic pleurisy physical signs are conspicuously absent, an important point in differential diagnosis.

Endocarditis is a frequent and most dreaded complication, its usual seat is in the left side of the heart and it is less likely to attack the aortic than the mitral valve. The heart should be the subject of very frequent examination since in even mild rheumatic infections it may become the seat of valvular disease of severe type. The proportion of heart complications in this disease is stated by some authorities to be as high as sixty percent. The onset may be gradual and difficult of diagnosis, while dyspnœa and palpitation may appear as features of a rheumatic attack with merely a functional cardiac disorder. The endocarditis is more frequently seen in youthful patients and is usually of the vegetative type. The heart may regain its normal condition but most of the cases of chronic endocarditis seen in practice are the result of rheumatic infection.

Infective or malignant endocarditis may occur, but inflammations of the myocardium are believed to be rare.

In consideration of the sequelæ of acute rheumatism, chorea, exophthalmic goitre and acute nephritis, and the permanent joint changes similar to those of chronic articular rheumatism and arthritis deformans, should be mentioned.

The prognosis. Recovery is usual in non-complicated cases. The duration of the acute stage of the disease when untreated is about 16 days but with proper treatment this may be much shortened. In many instances the infection leaves the patient with a permanently impaired heart. Rarely the patient passes on to the condition known as chronic rheumatism.

Death, when it takes place, is usually the result of hyperpyrexia or cardiac complications.

Prophylaxis. Persons subject to the disease should avoid excessive muscular exertion and especially exposure to cold and wet. Their clothing should be warm, preferably of woolen next to the skin in winter and of linen during the hot months. Too much carbohydrate food and malt beverages should be avoided, and the liver and bowels should be kept active. Daily baths, cold, preferably, if well borne, should be taken in order to keep the skin active and healthy. Out-door life and proper exercise are important.

Treatment. The patient should be kept in bed, upon a soft mattress and covered with blankets, not sheets. Calomel followed by a saline should be administered and the bowels should be kept freely open during the whole course of the disease.

Medicinal Treatment. The salicylates are an exact chemical limitant of the action of the causative bacteria, but the problem is to administer these in sufficient dosage to accomplish our object without injury to the heart, stomach or kidneys. Salicylic acid and sodium salicylate, especially the former, are

very likely to disturb the stomach, and, being eliminated through the kidneys, these organs are likely to receive harm. The acid in large doses diminishes the contractile power of involuntary muscle fibre and consequently its administration may result in acute cardiac dilatation. The ideal drug would be an organic combination of the salicly radical which would pass through the stomach unchanged to be spilt up in the intestines. Sixty to eighty grains (4.0 to 5.33) per day of the salicyl radical are necessary to cause a disappearance of the symptoms within a week and so great a quantity is likely to be harmful, and certainly is objectionable, to the patient. The problem being to bring the salicylate into direct contact with the joint in as great a quantity as possible and to prevent its getting into the circulation, the following ointment is prescribed: ℞ acidi salicylici, olei terebinthinæ, adipis lanæ hydrosi, of each one drachm (4.0), unguenti, q.s. ad one ounce (30.0). Sig. Rub one drachm (4.0) thoroughly into the diseased joint twice a day. The fact that a curative quantity of the salicyl radical is absorbed may be proven by finding salicyluric acid in the urine within 20 minutes after an inunction.*

The acutely painful and tender joint of beginning acute rheumatism may cause the patient to rebel against this form of treatment but the administration of salophen (two drachms—8.0—in divided doses during 24 hours) or antipyrine salicylate in like quantity will ease the pain so that the inunctions may be employed.

During the administration of salicylic acid in any form the urine should be examined daily and the quantity, specific gravity, and presence or absence of albumin or casts noted. It should be remembered that salicyluric acid reduces Fehling's solution, consequently such a reaction should not be misunderstood.

The above treatment usually results in the disappearance of the acute symptoms of the disease within a week.

In hospital practice the use of sodium salicylate—grains xx (1.33)—and sodium or potassium bicarbonate—grains x (0.66)—every four hours will be found to be attended with excellent results but in privtae practice such dosage is objectionable for obvious reasons. The alkali may be diminished when the reaction of the urine becomes alkaline. With this form of treatment it is very necessary that the bowels be kept freely open, that water be drunk copiously and that the condition of heart and kidneys be carefuly watched. When the acute symptoms of the disease have abated the dosage should be diminished. Certain authorities advocate the use of salicin, phenyl salicylate (salol) or methyl salicylate (oil of wintergreen) but these drugs seem to have no advantage over those above mentioned.

Certain feeble and anæmic patients are not benefited by the alkalies or

*Test for salicyluric acid: To a test tube of urine add 10 drops of the tincture of ferric chloride and in the presence of salicyluric acid a port wine color will result.

salicylates and in these iron, codliver oil, potassium iodide and other tonics and alteratives are indicated.

In gouty patients an attack of acute rheumatism seems to be best treated by a combination of colchicum and the salicylates.

When the salicylates are too disturbing to the stomach they may be given *per rectum* in dosage of 20 to 40 grains (1.33 to 2.66) in solution every four or six hours.

If larger doses are injected it is wise to add a few drops of tincture of opium.

Acetyl-salicylic acid (aspirin) is recommended as a substitute for the more commonly used salicylates, chiefly because it passes unchanged through the stomach, causing no disturbance to this organ, and is split up in the bowel; its taste is less unpleasant and it is less likely to cause tinnitus. Its dosage is from ten to fifteen grains (0.66 to 1.0) in powder or capsule every three or four hours.

It may be said in conclusion that while various other drugs have their advocates the general consensus of opinion is that in salicylic acid and sodium salicylate we have the most efficacious treatment for acute rheumatism. Disadvantages they have it is true, such as their tendency to disturb the stomach, heart and kidneys and to produce tinnitus aurium (which may be relieved by sodium bromide), or even deafness, and while their use does not prevent relapse possibly because their administration is not long enough continued, nor heart complications, it does relieve the pain quickly and effectively, enables the patient to sleep and causes the fever to fall within a few days.

With regard to hyperpyrexia, energetic cold bathing—70° F. (21.1° C.)—or cold packs are the only means of treatment which have given good results. While the patient is being moved to undergo either of these procedures morphine may be given hypodermatically to control the pain and strychnine or alcohol may be used to counteract any tendency toward collapse.

The treatment of other complications, pericarditis, endocarditis, etc., will be dealt with in the sections upon these diseases.

While the febrile movement and the other acute symptoms persist the diet should be of milk, soups and semi-solids. A return to ordinary diet should not be allowed for at least a week after the subsidence of the joint symptoms.

Menzer has prepared a serum from streptococci from the tonsils of rheumatic patients and has used it in more than 30 instances with the following results: The treatment caused no pain or other local reaction as a rule. A general reaction, chilliness, fever, and skin eruptions, often resulted. The dose used was from 1½ to 5 ounces (50.0 to 150.0). He believes that in acute instances the course of the disease was shortened, and he particularly states that the treatment seemed definitely to prevent severe endocarditis.

Local applications of various kinds may relieve the joint pain and swelling.

The affected parts should be swathed in cotton covered by oiled silk which will protect from traumatism and maintain an even temperature. Often immobilization by means of splints and the use of sand bags and pillows will add to the comfort of the patient. It is to be remembered in the application of splints, etc., that mid-flexion is the proper position in which to place the joint. Blisters of cantharides may relieve the pain in the acute stage and are often useful later in the disease. Care should be taken lest their action be carried too far. Injections of 10 to 15 drops (0.66 to 1.0) of 1 percent. solution of phenol beneath the skin of the joint are advocated. These may be repeated once or twice daily and are said to relieve the pain to a considerable extent. Painting with tincture of iodine or applications of iodine ointment are likely to accomplish little, but a 10 to 20 percent. ointment of ichthyol in lanolin is highly recommended. If wet dressings are applied the temperature should be warm. Among the most efficacious of these is Fuller's lotion (sodium carbonate 6 parts; laudanum 80 parts; glycerin 16 parts; water 72 parts), equal parts of guaiacol and glycerin; fluid extract of belladonna 20 drops (1.33) to the ounce (30.0) of glycerin; and oil of wintergreen. These should be applied upon gauze compresses and renewed twice daily.

After the acute stage is over the joints will be much benefited by properly applied massage and passive motion; warm and steam baths and galvanic electricity will also be found useful.

SEPTICÆMIA AND PYÆMIA.

Synonym. Bacteriæmia.

Definition. Septicæmia and pyæmia are febrile diseases caused by the existence in the blood of pathogenic micro-organisms and characterized by recurring chills and irregular rises and falls of temperature. From these affections sapræmia or toxæmia are to be differentiated, the latter being the result of the local development of bacteria and the taking up by the blood of the toxic products of their growth. The distinguishing mark of pyæmia is the occurrence in the various tissues and organs of metastatic pus foci; in septicæmia this manifestation does not take place.

Ætiology. Surgical septicæmia is usually considered to be a result of infection by pyogenic micro-organisms, particularly staphylococci and streptococci, while to the physician the term septicæmia signifies a condition caused by the presence of any variety of pathogenic micro-organism in the blood and tissues while a demonstrable focus of infection may or may not be present.

The basis of pyæmia is analogous to that of septicæmia with the added factors of thrombosis and embolism. To these latter the occurrence of the metastatic abscesses is due. For instance, a septic phlebitis may occur with the formation of an infective thrombus from which bits of infectious matter

may become detached and may be borne as emboli by the blood current until their final lodgment in a vessel the lumen of which is too narrow for their passage. Here such infectious particles become stationary and set up inflammatory processes which soon become abscesses. An example of this often occurs in infective or malignant endocarditis in which bits of the valvular vegetations may become detached and carried as emboli by the circulation, until, lodging in some perhaps remote part of the body, they result in abscesses.

Emboli from septic processes in the periphery and in the bone-marrow are most likely to lodge in the lungs, those from the tissues drained by the portal system, in the liver, those from the female organs of generation, in the pelvic tissues, those from the left side of the heart and those whose size permits of passage from the right side of the heart through the pulmonary circulation to the left heart, in the brain, kidneys or spleen.

Of the more common varieties of septicæmia puerperal infection due to retained secundines, lacerated cervix or perinæum, scarlatinal or erysipelas infection and the process which may result in severe forms of enteric fever, gonorrhœa, diphtheria and other acute infectious diseases, should be mentioned.

Symptoms. Before the appearance of constitutional symptoms, those of the primary local lesion, if such is present, will be noticed. The onset of the septicæmia or pyæmia is usually marked by a severe chill during which the temperature may rise to 103° to 105° F. (39.4° to 40.5° C.). Following this manifestation there is profuse sweating succeeding which the temperature may rise again. Chills, rises of temperature and sweats succeed one another at intervals of one or two days, a general tendency of the fever to be higher at night being not unusual. The patient is prostrated, thirsty, suffers from anorexia and nausea, and perhaps vomits. Flesh is rapidly lost, exhaustion becomes profound and a condition of semi-coma may supervene; transient erythematous eruptions may appear.

Local symptoms are frequent in pyæmia and are due to the lodgment of the septic emboli. In the lungs these cause pain, rapid respiration and cough; in the liver, pain with tenderness, enlargement of the organ and jaundice; in the subcutaneous tissues, pain, tenderness and swelling, followed by abscess formation; in the joints, the usual signs of inflammation and the presence of intra-articular effusion; in the kidneys, albumin or blood in the urine. Emboli lodging in the brain, unless they shut off the blood supply of portions of this organ essential to the performance of the body functions, are not likely to be suspected. Emboli of the spleen cause pain in the side, tenderness and splenic enlargement, while metastatic abscesses of the pancreas are evidenced by deep pain and tenderness in the region of that organ.

The diagnosis of septicæmia and pyæmia usually offers little difficulty when a primary focus is present. When this aid is absent blood examination

will reveal a considerable leucocytosis and cultures may show the presence of the causative micro-organism. Enteric fever may be differentiated by means of the Widal reaction and malaria by examination of the blood and by the test of quinine treatment. Gonorrhœa and prostatic abscess, as well as tuberculous nephritis and pyelitis due to the presence of calculi, may be factors in causation. In malignant endocarditis a murmur is usually present but both this condition and acute osteo-myelitis may be unsuspected.

The prognosis is always serious in pyæmic conditions. Puerperal septicæmia is the least grave type of the affection if proper treatment is instituted. Chronic infections may last for months with irregular temperature and gradually increasing anæmia and emaciation until death supervenes.

Treatment. Much may be done in the way of prevention of puerperal septicæmia by proper cleansing of the patient's genital tract, the physician's hands and instruments, the complete removal of the contents of the uterus and proper after-treatment of cervical, vaginal and perinæal lacerations. Credé recommends the sterilization of the patient's genitals after parturition by first removing all clots, etc., and then inserting a vaginal suppository consisting of 1½ grains (0.1) each of powdered talc and collargol and 30 grains (2.0) of cocoa butter; the vagina is then packed loosely with sterile gauze which later, with the introduction of another suppository, may be renewed. If infection takes place douches of 1 to 2,000 to 1 to 5,000 collargol solution are given and if there is any retention of placenta or membranes these should be removed by operation. In advanced infection the intravenous injection of 2 to 2½ drachms (8.0 to 10.0) of collargol solution is advised. This last procedure may also be employed in septicæmia and pyæmia of other forms.

The early treatment of septicæmic and pyæmic states by surgical means is most important. The primary focus should be rendered thoroughly clean by means of antiseptics, the curette or even the actual cautery. All collections of pus which can be reached should be opened and drained and even amputation of a limb may be necessary. Subcutaneous injections of antiseptics into the tissues may be given just as has been recommended in erysipelas (p. 113). The bowels, kidneys and skin should be kept active in order that the poisons may be eliminated in so far as is possible and this may be furthered by the administrations of high rectal irrigations of hot saline solution given two or three times daily and two to four gallons (8 to 16 litres) at a time.

The temperature may be relieved by sponging with cool water and quinine sulphate may be given in doses of 15 to 30 grains (1.0 to 2.0) daily. If the coal tar antipyretics are employed much caution is necessary because of their depressing effect. The sweating may be controlled by $\frac{1}{10}$ of a grain (0.006) of morphine with $\frac{1}{100}$ of a grain (0.0006) of atropine, by agaricin one to two grains (0.065 to 0.13), or dilute sulphuric acid 15 to 30 drops (1.0 to 2.0).

Tincture of iodine 20 to 25 drops (1.33 to 1.66) daily in divided doses, given in syrup or rice-water is recommended and inunctions of Credé's ointment may be employed. Intravenous injections of collargol solution as advised above may be tried. Stimulation by means of alcohol and strychnine is always indicated and in the later stages hypodermoclyses of hot normal saline solution may become necessary.

Treatment by means of antistreptococcus serum should never be omitted, especially in severe infections; 5 to 7½ drachms (20.0 to 30.0) may be injected every six to eight hours, the doses being diminished as improvement is manifested.

The diet throughout should be of the most nutritious and easily digestible character and of plentiful amount.

HYDROPHOBIA.

Synonyms. Rabies; Lyssa.

Definition. An acute specific infectious disease to which all warm-blooded animals are subject. It is communicable to man by inoculation and is characterized by tonic spasms usually beginning at the larynx.

Ætiology. The dog is particularly prone to this disease and when the affection occurs in man it is usually through the bite of this animal. Hydrophobia is also seen in wolves, cats, skunks and even cows and may be inoculated into rabbits, horses and other domestic animals.

While undoubtedly the result of infection with a micro-organism, the specific cause of the disease has not been isolated. The toxic substance exists in the central nervous system and in certain secretions, particularly the saliva, by means of which it is usually transmitted.

By no means all the individuals bitten by rabid dogs suffer from hydrophobia. Horseley gives the figures as 15 percent., while the mortality among those bitten by wolves is much larger, being from 40 to 80 percent. Children more frequently suffer from the disease than adults and bites upon the face and hands, probably because these parts are more often unprotected by clothing which may wipe off the saliva before the teeth of the animal reach the tissues, are more likely to be followed by hydrophobia than those upon other parts. Punctured wounds are considered especially likely to be serious. It is certain that many cases reported as hydrophobia are in reality not this disease at all and some go so far as to assert their skepticism as to its existence as a nosological entity.

Pathology. The characteristic morbid changes present in hydrophobia are microscopical and are, so far as is known, confined to the nervous system, the rabic virus likewise is present in the brain, cord and peripheral nerves but is not found in other organs and tissues. The pathological conditions

consist of a dilatation of the vessels of the brain, medulla and upper cord and a collection of leucocytes in the peri-vascular sheaths and about the nerve cells, particularly those of the motor ganglia. Van Gehuchten and Nelis have described certain alterations in the peripheral ganglia of the cerebro-spinal and sympathetic systems consisting of a proliferation of the normal cellular elements which tends later to destruction and a replacement by round cells. Analogous changes are observed in certain other diseases as botulismus and diphtheria.

In 1903 Negri described as constantly present in the nerve cells of rabetic animals, certain bodies, which he believed to be protozoa, and which varied in size and shape according to their position in the cell. They are found especially in the cells of the hippocampus major and have been observed also in the cells of the pons, in Purkinje's cells and in cells in other situations. A number of different opinions exists as to the character of these bodies and also as to their diagnostic value.

Inasmuch as there are no pathological appearances which are universally admitted to be characteristic of the disease, the diagnosis must remain uncertain. Many instances of tetanus, septicæmia and tuberculous meningitis have been reported as hydrophobia. Of fifteen consecutive deaths ascribed to hydrophobia and so recorded by the New York City Department of Health not one, after careful investigation, could fairly be ascribed to this cause.

Symptoms. The period of incubation is from six weeks to two months although, rarely, symptoms have been reported as appearing within two weeks after the infection, and incubations of a year or more have been observed.

The symptoms of the attack may be divided into three stages. Of these the first or *premonitory stage* is characterized by local manifestations about the bite, such as pain, tenderness and redness. The patient's mentality is depressed, he suffers from headache, anorexia and insomnia; he is feverish and perhaps melancholic and anxious. Any sudden noise or flash of light is startling. The voice is hoarse, the larynx may be congested and there may be dysphagia.

The spasmodic stage follows the stage of premonition after about 24 hours. The patient is most excitable, restless and hyperæsthetic. Any peripheral irritation, even a sound or draught of air, brings on a pronounced reflex spasm. This affects chiefly the muscles of the throat and larynx and is particularly likely to be induced by the act of swallowing. The spasm is painful and is accompanied by marked dyspnœa. The fact that the spasm is so closely associated with the act of deglutition causes the dread of water. The saliva is usually increased and cannot be swallowed without causing a paroxysm. Maniacal excitement may accompany the spasm and restraint may be necessary, but in the intervals the patient is quiet, his mentality is normal and he appears anxious lest he do harm during the seizures.

The temperature is elevated—from 101° to 103° F. (38.5° to 39.6° C.)—and the pulse is accelerated. This stage lasts from one to three days and is succeeded by

The paralytic stage. This is characterized by exhaustion upon the part of the patient; he becomes quiet and gradually comatose. The cardiac action becomes weaker and weaker and death supervenes in syncope.

The diagnosis is not particularly difficult, the history and the length of the incubation period being important differential points.

Pseudo-hydrophobia or lyssophobia may closely simulate true rabies. This condition is likely to follow, particularly in neurotic individuals, the bite of an animal and it may even be characterized by paroxysms very like those of hydrophobia. The patient's symptoms usually ameliorate upon treatment although their duration is longer than in true rabies. The disease does not progress nor is there a rise of temperature. The diagnosis of hydrophobia may be assured by inoculating rabbits or guinea pigs with bits of the medulla of the supposedly rabid animal; the animals, if true rabies is present, will within 15 to 20 days develop the paralytic type of the disease. It is advisable, however, to inoculate a second series of animals, since various drugs such as strychnine and atropine are capable of producing symptoms identical with those of dumb rabies. The changes in the peripheral ganglia of the cerebrospinal and sympathetic nervous systems of the affected animal are also characteristic. These may be examined and the diagnosis determined within a few hours after the animal's death; he must, however, die a natural death. The ganglion of the vagus nerve is usually examined and shows a proliferation and finally destruction of the normal cells and a replacement by round cells. It must be remembered that Marinesco has shown that identical changes occur in sausage poisoning (infection with the *bacillus botulismus*) and analogous ones are met in tetanus and diphtheria.

Supposedly rabid animals should not be killed unless absolutely necessary, but should be confined in order to ascertain if they are certainly affected with the disease.

The prognosis in fully developed infections is distinctly bad, the patient dying usually in from two to six days. Cauterization of the bite and the Pasteur treatment, when undertaken in time, are very effectual.

Treatment. Prevention of rabies is easily accomplished by the systematic muzzling of all dogs.

The bite having been inflicted the wound should be at once sucked, preferably by the patient himself, and the mouth immediately washed. Cauterization with a red hot iron, the Paquelin or the galvano-cautery should be practised as soon as possible. Failing these means stick silver nitrate, pure phenol or potassium hydrate should be employed; the wound should not be allowed to heal.

The Pasteur treatment is a method of prevention based upon incompleted experiments made by the distinguished French scientist whose name is immediately suggested by the word hydrophobia. It is founded upon his discovery that the poison of this disease has its seat in the nervous system, especially in the brain, medulla and cord. By inoculation of virus from the nervous tissues of rabid animals through a series of 50 rabbits a virus is produced which acts after an incubation period of 7 days. This is termed "fixed virus." The spinal cords of the last rabbits of such series contain this virus in great intensity but its potency is quickly reduced by exposure of the cords to dry air, consequently they are dried in sterile glass vessels with potassium hydrate. In dogs inoculated with an emulsion made from fragments of medulla of diminished virulence and then with preparations of cord of higher potency immunity from inoculation by fresh cord substance is reduced. Working on this basis Pasteur inoculated human subjects, who had been bitten, with emulsion of two weeks old cords and on each successive day to the number of 12 gave other inoculations until those but one day old were used. By this treatment he succeeded in rendering the individual immune. At present the method employed in most Pasteur institutes consists in giving inoculations from cords of increasing virulence in rather more rapid successions. Below is given a tabulated statement of the results of this treatment at the institute in Paris.

Year.	Persons Treated.	Deaths.	Percent. of Mortality.
1886	2,671	25	0.94
1887	1,770	14	0.79
1888	1,622	9	0.55
1889	1,830	7	0.38
1890	1,540	5	0.32
1891	1,559	4	0.25
1892	1,790	4	0.22
1893	1,648	6	0.36
1894	1,387	7	0.50
1895	1,520	5	0.33
1896	1,308	4	0.30
1897	1,521	6	0.39
1898	1,465	3	0.20
1899	1,614	4	0.25
1900	1,420*	4*	0.35*
1901	1,321	5	0.38
1902	1,105	2	0.18

During 1902, one thousand, one hundred and six persons were treated, of whom three died from hydrophobia. Inasmuch as in one instance the disease

* Corrected to 1,420, 5, and 0.35 respectively.

declared itself before the end of treatment, this is excluded from both "persons treated" and "deaths."

The time necessary for the treatment is 15 days, two inoculations being given daily to ordinary patients. To those whose treatment has been instituted late or in whom the wounds are upon the face or head four to six inoculations per day may be given.

The following is a condensation of the instructions published by the institute at New York, for the benefit of those bitten by supposedly rabid animals.

Cauterization should be practised as soon after the bite as possible. Late cauterization is without benefit and possesses the disadvantage of inducing a false sense of security. The bite should be treated in other respects just like any infected wound.

The patient should be *immediately* sent to the institute, since each day of delay renders the prognosis less favorable. The inoculation is harmless and it is better to inoculate before learning the result of the biological diagnosis even though we treat those who do not possess the disease. The inoculation has the advantage of conferring immunity which persists for several years.

The dog or other animal should be confined and kept under observation until it dies or recovers, and notes of its condition and progress should be sent to the institute. If it is impossible to keep the animal alive it should be killed, its head should be severed with a sterile knife, a portion of the medulla removed, and placed in a sterile bottle containing a previously boiled mixture of equal parts of glycerin and water. This bottle should be sealed and sent to the institute for examination and inoculation. A report upon the stomach contents of the animal should also be forwarded to the institute.

After the onset of the symptoms they should be controlled in so far as possible. The patient should be placed in a darkened and quiet room in charge of two attendants. While the milder sedatives such as the bromides and chloral may be effectual at first in overcoming the nervous irritability, it is wiser to employ inhalations of chloroform and hypodermatic injections of morphine from the beginning. The difficulty in swallowing may be relieved by the local use of cocaine but it is often necessary to administer both food and drink by means of the rectal tube.

TETANUS.

Synonyms. Lockjaw; Trismus.

Definition. An acute infectious disease characterized by repeated tonic muscular spasms of increasing intensity.

Ætiology. Tetanus occurs in human beings and in lower animals and is the result of the growth within the organism of a specific micro-organism, the bacillus of tetanus. This bacillus is found in the soil, especially in tropical

countries, in the intestines of ruminant animals and in their excreta, in the fluids of putrefying wounds and in pus. Its portal of entry is usually by means of a wound, especially one of the hand or foot and a punctured or contused wound rather than one due to incision. While idiopathic tetanus may occur, in most instances a thorough search will reveal a slight loss of continuity of the skin which has afforded entry to the bacillus. Tetanus may occur as a result of umbilical infection in the new-born and before the introduction of antiseptic dressings was a frequent cause of death of negro infants in the West Indies. The wound of the blank cartridge of the Fourth of July toy pistol frequently results in tetanus, not, however, from any infective character of the charge of the weapon.

The disease is predisposed to by exposure to cold and wet and, while it affects all ages and both sexes, is more common in males. Epidemics have been occasionally met.

The symptoms are not the result of the presence of the bacilli in the blood, for these remain and develop at the site of the wound; the toxins produced by their growth are responsible for the constitutional manifestations.

Some years ago a large number of infections was reported as being caused by injection of diphtheria antitoxin but investigation proved that these were due to antitoxin from one source only, and that the substance had not been prepared under proper precautions.

Pathology. There are no characteristic morbid changes in this disease. The wound is in no way typical and while granular degeneration of the nerve cells, inflammatory conditions of the nerves, and congestion, extravasations and exudates of various parts have been found, these are neither constant nor essential.

Symptoms. The usual incubation period is about 10 days. The onset of the disease may be marked by a chill or chilly sensations but this is not the rule, the initial symptoms being stiffness of the neck and jaw; mastication is difficult but not painful. The muscles of the abdomen, back and limbs become gradually stiff and the body becomes so inflexible that it may be raised as if made of a single piece of wood (*orthotonos*). In marked instances it may be impossible to force the jaws apart. *Risus sardonicus* may be present as evidenced by a drawing out of the corners of the mouth and elevation of the eyebrows; paralysis of the muscles of the face, dysphagia with laryngeal and œsophageal spasm may be noted; this is the so-called head tetanus of Rose and usually is the result of a wound of the head with injury to the fifth nerve.

Paroxysms may be induced by a touch, a breath of air or any slight noise; during these the muscles of the trunk contract, producing arching of the back so that the body is supported by the head and heels (*opisthotonos*), or the body may be bent forward in the position of *emprosthotonos* or side-

ways in the posture of *pleurosthotonos*. The tongue may be bitten in spasms of the jaw or, in marked instances, the chest may be so compressed by muscular contraction as to cause severe pain and rapid respiration. The opening of the larynx may be contracted producing a condition of asphyxia. Extreme pain is an accompaniment of the paroxysm and the body may be bathed in perspiration. Between the attacks, which occur at intervals varying from a few minutes to several hours, the patient may be able to walk about but the relaxation is not complete.

Usually the temperature is only slightly above normal but may rise to 106° F. (41.1° C.) or to 110° F. (43.4° C.) or even higher just before death, which may occur during a paroxysm, from asphyxia or cardiac failure, or from exhaustion. The pulse and respiration are, as a rule, accelerated. The mind remains clear. Constipation is frequent and often serious since attempts at relief are likely to induce the paroxysm.

The diagnosis, particularly in traumatic tetanus, is usually not difficult; trismus occurs in tetanus but not in hydrophobia, and in strychnine poisoning in the intervals of the paroxysms there is no rigidity and the convulsive attacks affect the limbs more than in tetanus. Bacteriological tests may be employed to assure the diagnosis.

The prognosis in traumatic tetanus is bad, the mortality being about 80 percent. as against less than 50 percent. in the idiopathic form. Death usually takes place within six days after the onset; patients surviving longer than this period are likely to recover. The disease is especially fatal in children. A prolonged incubation period is a favorable sign as are also a localization of the spasms in the face and neck and an absence of elevation of temperature.

Treatment consists first in thorough cleansing and cauterization of the wound. Particularly should all bits of wadding, powder, etc., be removed from blank cartridge wounds; the actual cautery, phenol or silver nitrate should then be used and the wound dressed antiseptically. Dusting the wound with powdered tetanus antitoxin has been suggested, and a prophylactic injection of at least 5,000 units of antitoxin should be given The patient should be placed in a darkened room, as far removed from irritant influences as possible; he should receive no visitors, one attendant being sufficient, and the strictest quiet should be enjoined.

While the results obtainable from antitoxin treatment are not all that could be hoped, injections should be instituted in all instances. It has been shown that the route of the tetanus toxin to the nerve centers is along the motor nerves and less directly through the blood and lymphatics, and since only that portion of the toxin which is in the blood and tissues outside the nerves can be reached, the antitoxin should be injected directly into the veins and into the tissues about the focus of infection. The diagnosis having been made by

means of bacteriological tests, injections should be immediately begun and continued daily for at least two weeks from date of the injury. The injections should be into the median basilic vein and each dose should consist of from 2½ to 5 drachms (10.0 to 20.0). It is better to give too large doses than too small. Intra-neural injections, the motor nerves supplying the injected region having been exposed as near the spinal cord as possible, of from 5 to 20 minims (0.33 to 1.33) are advised in connection with the above treatment. The cauda equinæ may also be injected by means of lumbar puncture, certainty that the injection has been given directly into its nerves being evidenced by twitchings. In urgent instances the injections may be given directly into the cord itself at the level of the sixth or seventh cervical segment, the risk of injury being less than that of the spread of the infection. After these more drastic measures attention should be given to the local lesion and the surrounding tissues should be fully injected with the antitoxin. The entire process described above may be repeated daily until there is subsidence of the symptoms. Anæsthesia is of course necessary in this treatment. Subdural injections of antitoxin by means of trephining have been practised but these would seem in no way superior to the less difficult injections into the tissues, veins, nerves and cord.

Excellent results have been reported from the employment of subcutaneous injections of an emulsion of rabbit's brain, the basis of the treatment being the fact that the tendency of tetanus toxin is to become incorporated and fixed in the nerve structures.

At least one patient has been cured, after the antitoxin treatment had seemed to fail, by the removal of cerebrospinal fluid by means of lumbar puncture and injecting into the subarachnoid space 45 minims (3.0) of a solution containing 1½ grains (0.1) of eucaine, ⅓ of a grain (0.022) of morphine and three grains (0.2) of sodium chloride. An amelioration was immediately noted and the process was repeated several times, the patient ultimately recovering.

Very recently treatment by means of the injection of a solution of magnesium sulphate into the spinal canal by means of lumbar puncture has been suggested and the few results so far reported seem to justify the method; 25 and 12½ percent. solutions have been employed, the amount injected being about 15 minims (1.0) for every 25 pounds of the patient's weight. Repeated injections may be given and the treatment is said to restrain the convulsions and relieve the pain, thus preserving the patient's strength and preventing excessive metabolism and heat production; the spasm of the muscles of the jaw is lessened, thereby permitting the administration of food by mouth. The action of the salt is continued for a considerable period without depressing the heart and no ill-effects are likely to be produced save an inhibition of the action of the bladder, rendering catheterization necessary. It is possible that the drug exerts some chemical action upon the toxins of the disease

but more probably its effect is purely symptomatic. This form of treatment may be employed to advantage in connection with that by means of tetanus antitoxin.

Treatment by means of the repeated hypodermatic injection of two percent. phenol is said to act favorably upon the nervous system and, to a certain extent, to neutralize the effect of the toxin of the disease.

Amputation of the wounded limb has its advocates.

With regard to the treatment of the paroxysms it may be said that they are best controlled by chloroform inhalations but they may be avoided, or at least decreased in intensity, by the use of various hypnotics. Of these morphine given hypodermatically is the most efficient and the patient may be kept under its influence. Hydrated chloral given together with the bromides may prove effective; physostigma—$\frac{1}{4}$ to $\frac{1}{2}$ a grain (0.0165 to 0.033)—given every three to six hours and curare—$\frac{1}{25}$ of a grain (0.0026)—administered hypodermatically, the dose being gradually but with caution increased, may benefit the condition.

The resulting stiffness frequently observed during convalescence may be markedly relieved by the tincture of conium in doses gradually increased until the physiological effects are noted.

Stimulation is necessary when the heart and circulation become depressed and warm baths may aid in relaxing the spastic condition and are grateful to the sufferer.

The nourishment should be maintained at the highest possible level since it is said that tetanus antitoxin does not exert its best influence in conditions of impoverished nutrition. The diet, however, must of necessity be chiefly of fluids and feeding by the nasal tube or *per rectum* becomes imperative when deglutition becomes difficult or impossible.

ANTHRAX.

Synonyms. Malignant Pustule; Wool Sorter's Disease; Splenic Fever; Splenic Apoplexy.

Definition. An infectious disease of animals, particularly cattle and sheep and transmissible to man.

Ætiology. This disease in animals is widespread but is less common in America than in Europe and Asia. In man it occurs as a result of infection through the skin, lungs or digestive tract and is most often seen in those who work about animals or animal products, such as shepherds, hostlers, tanners, butchers, etc. The contagium is transferred to man by means of the hides, flesh, blood and secretions of affected animals and, while the possibility of contracting the infection through an intact skin or mucous membrane is to be considered, it is probable that a solution of continuity of the integument is necessary for a successful inoculation.

The specific cause of anthrax is a cylindrical bacillus of great vitality and the largest of the pathogenic bacteria. It is termed the *bacillus anthracis* and exists in great numbers in the blood and tissues of the infected subject. While the bacilli themselves may be easily destroyed, their spores are very resistant to disinfecting agents. Animals acquire the disease through abrasions such as insect bites, etc., by feeding upon the flesh of other animals dead from the infection and by grazing over fields where the bacilli are present, for these have been found upon the herbage over the buried bodies of animals which have died of anthrax.

Symptoms. The incubation of anthrax is usually about one week and for convenience in description the disease may be considered as occurring in two forms, the external and the internal.

External Anthrax. a. Malignant pustule occurs as a result of inoculation and most often begins upon the exposed surfaces of the face, hands or arms. The first symptom is pain, itching or burning in character, at the site of inoculation. Soon a reddened spot appears which quickly becomes papular and then vesicular, the vesicle containing clear or bloody serum. The surrounding tissues become indurated and, the original vesicle bursting, other vesicles develop about the indurated area. The induration extends and becomes darkened at its center, a brown eschar usually appearing within 36 hours. The neighboring tissues are œdematous and, the infection spreading along the lymphatic channels, these become reddened, swollen and tender and the adjacent lymph ganglia are enlarged.

There is accompanying constitutional disturbance, the temperature and pulse rate being elevated and other symptoms of an acute infection being present. Later the temperature may fall below normal and in fatal instances death supervenes after from three to five days. In favorable instances with mild constitutional symptoms the vesicles may scab and with the induration gradually disappear or the eschar may slough away leaving the wound to heal.

b. Malignant anthrax œdema usually begins in the eyelid, spreading thence to the face; it also may occur in the hands or arms; papules and vesicles do not appear but there is marked œdema which may go on to gangrene. The constitutional symptoms may precede the local manifestations and are usually of severe type. Recovery from this form of the disease is practically unknown.

A marked characteristic of both forms of the infection is the absence of mental anxiety, the mind often remaining wholly unaffected.

Internal anthrax also occurs in two forms. *a. Intestinal anthrax* or *mycosis intestinalis* results from the ingestion of the meat or milk of infected animals or from the transference of the contagium of external anthrax to the digestive tract. There is likely to be a chill at the onset which is succeeded by the symptoms of intense intoxication, such as vomiting, diarrhœa with bloody stools, general pains, fever and abdominal tenderness. In the severe

infections the respiration is difficult, cyanosis and pronounced mental symptoms are present and there may be extravasations of blood from the mucous membranes or petechial hæmorrhages into the skin. There is splenic enlargement, the blood is dark, remains uncoagulated for a considerable period *post mortem* and, in the later stages of the disease, may contain the *bacillus anthracis*. Convulsions may be observed shortly before death.

b. Wool sorter's disease is seen amongst those who work in wool or hides, especially those imported from South America or Russia, and is the result of the inhalation or of swallowing the contagium. There is seldom an external lesion and the onset of the infection is usually abrupt with a chill, high temperature, general pains and prostration. The heart action is rapid and feeble and there is dyspnœa and thoracic pain. Cough with accompanying physical signs of bronchitis is not infrequent. Death may occur in collapse within 24 hours or the disease may be prolonged with vomiting, diarrhœa and cerebral symptoms. In such infections the capillaries of the brain have been found to contain the *bacillus anthracis* in great numbers.

Rag picker's disease is the name given to a pulmonary and pleural anthrax infection which is accompanied by a general intoxication.

The diagnosis of anthrax of the external form may be made from the local appearances and from the history. Bacteriological examination of the contents of the vesicle may reveal the presence of the specific micro-organism. Inoculation experiments are also useful. Internal anthrax is less simple of diagnosis but may be suggested by a history of exposure.

The prognosis is distinctly bad, particularly in the internal types.

Treatment. Much may be done in the way of prevention by the disinfection of hides, wool, rags, etc., by means of steam under pressure. Hides, unfortunately, are damaged by this process. All animals dead from the disease should be burned, not buried, grazing over infected pastures should be prohibited and the thorough disinfection of infected buildings is of much importance.

The site of the lesion in external anthrax should be excised if possible or, if not, deep crucial incisions are to be made and followed by cauterization with the thermo-cautery, phenol or a solution of potassium hydrate. The wound should then be dressed with a strong solution of phenol or powdered with pure mercury bichloride. General or local anæsthesia may be necessary. Injections beneath the skin of the surrounding parts may be effectual in preventing the spread of the infection. Such solutions as ½ percent. phenol; 2 to 5 percent. tincture of iodine; iodine one part, potassium iodide two parts, water one thousand parts, may be injected several times daily. Mercury bichloride is also useful in this connection. The technique of such injections is as follows: At a distance of about ½ an inch from the margin of the indurated area the needle is inserted and the injection made; other

injections are given outside the periphery of the inflammation at such intervals that the tissue infiltrated with the chosen solution shall act as a continuous barrier to the progress of the infection. The injection of the solution of iodine and potassium into the enlarged lymph glands is also advised.

Internally we may give 10 to 30 drops (0.66 to 2.0) of tincture of iodine daily or ½ an ounce (15.0) every two hours of the mixture of iodine and potassium iodide mentioned above. Stimulants such as alcohol and strychnine should be prescribed as indications arise and the dietary should be as plentiful, nutritious and as digestible as possible.

Internal anthrax is likely to be little influenced by treatment. The bowels should be freely moved at the onset and kept open during the course of the disease in order that, if possible, the toxic matters may be removed; the treatment described above may be employed and the free exhibition of intestinal antiseptics is advocated.

An antiserum for the treatment of anthrax has been elaborated and from the results claimed would seem to merit a trial.

GLANDERS.

Synonyms. Farcy; Malleus Humidus.

Definition. An infectious disease particularly of the horse but communicable to other animals such as the sheep, rabbit, cat, dog and mouse; cows enjoy immunity. The disease is manifested by nodular growths in the nostrils (glanders) and under the skin (farcy).

Ætiology. The disease is rare in man but may be seen in stablemen and others who work about horses. Its specific cause is a micro-organism, the *bacillus mallei.* The infection is transferred to man by inoculation through an abrasion of the skin or through a mucous membrane, the contagium being given off in the discharges from the diseased animal.

Pathology. The characteristic lesion of glanders is the appearance of granulomatous tumors of varying size, composed of epithelial and lymphoid cells and containing the *bacillus mallei.* These tumors occur beneath the skin and on the mucous membranes where they soon break down forming respectively abscesses and ulcerations. The nodules have also been observed in the viscera and in the nervous and osseous systems.

Symptoms. Acute and chronic forms of both glanders and farcy occur in man.

The incubation period of *acute glanders* is from three to five days. The onset is characterized by the usual symptoms of beginning febrile disease; at the site of the infection there are redness and swelling, the nasal mucous membrane in the vicinity becomes first dry and congested, the appearance of the nodular tumors rapidly follows, and these soon break down becoming ulcers which discharge a muco-purulent or bloody secretion. The infection

may cause severe frontal headache due to accompanying involvement of the sinuses in this neighborhood. The submaxillary and cervical lymph glands become enlarged and may suppurate and the inflammatory process spreads to the nasal septum, to the mouth, pharynx and even to the lower air passages, causing pain on swallowing, cough with foul expectoration, and even pneumonia. A papular eruption, which soon becomes pustulous and may be mistaken for smallpox, may appear upon the face and upon the skin over the articulations.

Chronic glanders is difficult of diagnosis. Its symptoms resemble those of a chronic rhinitis or laryngitis for either of which it is likely to be mistaken. There are ulcerations of the nasal mucous membrane. The diagnosis may be made by inoculating the peritonæum of a guinea pig with the nasal secretion or with a culture grown from this substance. If glanders is present the testicles of the animal become swollen and inflamed within a few days and ultimately suppurate. The guinea pig dies within three or four weeks and nodules are found in the abdominal organs.

Acute farcy is evidenced by the symptoms of an acute infection accompanied by a subcutaneous nodule or an ulcer with a foul secretion. The neighboring parts become congested and œdematous and adjacent lymphatics are involved; "farcy buds," which are subcutaneous nodules along the course of the lymph vessels, develop and may suppurate. Intra-muscular abscesses and articular swellings may appear and rarely a pustular rash occurs. The nose is not affected and the urine may contain the *bacillus mallei.*

Chronic farcy is characterized by localized subcutaneous nodules, usually occurring upon the extremities; their development is sluggish and while they break down, forming abscesses or ulcers, there is no marked lymphatic involvement. The course is protracted and pyæmic symptoms or acute glanders may develop.

The diagnosis in acute glanders is seldom difficult but in the chronic form is less simple. Recently the agglutination test has been employed since it has been proven that while normal horse serum agglutinates glanders bacilli in a dilution of 1 to 200, that of a horse affected with glanders will agglutinate a 1 to 1,000 dilution. Mallein, a product of the growth of the glanders bacillus analogous to the tuberculin of tuberculosis, may be employed in diagnosis. Inoculation with this substance causes a rise of temperature when glanders is present, a rise in horses of 3.5° F. (2° C.) being considered proof that the animal is diseased, while an elevation of 1.25° F. (0.75° C.) is considered suspicious. Direct animal inoculation will quickly determine the presence or absence of the infection and implantation of cultures from the secretion upon cooked potatoes shows within three or four days an amber colored film, becoming by the end of a week red and encircled by a pale green area.

The prognosis in the acute forms is almost invariably fatal. In the chronic types about half the patients recover.

Treatment consists in the early excision and cauterization of the lesion; antiseptic dressings should then be applied. In the nasal form of the infection antiseptic sprays and gargles of dilute phenol or hydrogen dioxide are to be employed. Farcy buds should be incised and dressed antiseptically. Mallein has been employed in animals and has been administered internally to human beings with no very positive results. The patient's nutrition should be kept up by a supporting diet, symptoms should be combated as they arise, and stimulation is to be prescribed when indicated.

ACTINOMYCOSIS.

Synonyms. Lumpy Jaw; Big Jaw; Bone Tumor; Swelled Head.

Definition. A chronic infectious inflammatory disease of cattle and pigs, transmissible to man and caused by the *streptothrix actinomyces* or ray fungus.

Ætiology. The disease is common in cattle, is more frequently seen in man in Germany than in England or America and affects males more frequently than females. The fungus probably reaches the human organism upon the ingested food. Direct infection with meat or milk has, however, never been proven. It has been shown that the disease may be conveyed to cattle upon oats and other grains and it is not improbable that man may contract the disease in the same manner. The infection takes place usually through the mouth, teeth or throat, rarely through the skin or respiratory passages.

Pathology. The characteristic lesion is a miliary nodule, made up of a central mass of fungi radiating in all directions and surrounded by granulation tissue. The size of a single nodule is about that of a millet seed but numbers of these may be aggregated into tumors the size of a base-ball; about the larger tumors the connective tissue is greatly proliferated and finally suppuration with abscess formation takes place.

Symptoms. *a. The digestive tract.* The infection usually takes place through the mouth or decayed teeth, the jaw becomes swollen and the face so enlarged that the condition may be mistaken for sarcoma; sinuses discharging pus are often present. Rarely the tongue, pharynx, intestines or liver may be involved primarily, or secondarily as a result of metastasis. Actinomycotic appendicitis has been observed and the fungi have been demonstrated in the stools.

b. Pulmonary actinomycosis. Infection of the lungs by the ray fungus is not infrequent and occurs in three types. First, a form with lesions resembling those of chronic bronchitis, the sputum containing the fungi. Second, a miliary form in which tubercles occur resembling those due to the bacillus

of Koch but in which the actinomyces are demonstrable. Third, a destructive form characterized by interstitial lesions and abscesses which may form cavities. The pulmonary type of the disease may occur synchronously with involvement of the jaw or other parts. The cough is accompanied by a fœtid sputum, in which the actinomyces may be demonstrated, and fever, which is usually septic in character if suppuration has taken place. The course of the infection is protracted, the average duration being about 10 months; recovery is rare.

c. Actinomycosis of the skin is a chronic condition characterized by the development of cutaneous swellings which break down and result in ulcers in the discharge of which the fungi have been found.

d. Cerebral actinomycosis is a very rare type of the disease. It is characterized by the formation of abscesses in the brain, the pus of which may contain the mycelium.

The diagnosis can be assured only upon demonstrating the fungi in the pus or other discharges from the lesions; unless this can be done the condition is likely to be confounded with pyæmia, which, in actuality, it is.

Actinomycosis of the jaw may be differentiated from sarcoma by its more protracted course, greater tendency to suppuration and the presence of actinomyces.

Treatment in general consists in the administration of potassium iodide in doses of from 30 to 75 grains (2.0 to 5.0) daily, gradually increased to 90 to 120 grains (6.0 to 8.0) and the maintenance of the patient's strength by nourishing food, arsenic and other tonics. In pulmonary actinomycosis, in addition to the internal administration of potassium iodide, antiseptic inhalations should be employed as in fœtid bronchitis (see p. 636) and the vapor of iodine is particularly effectual. The internal measures applicable in the fœtid form of bronchitis are also useful and especially the preparations of eucalyptus. Actinomycosis of the intestine necessitates attempts at achieving intestinal antisepsis.

If the tumor is so situated as to allow of excision this should be performed and the dead bone and infected tissues removed, the wound and sinuses drained and irrigated with a solution of iodine and potassium iodide or of iodoform and glycerin. Cauterization of the infected tissues with zinc chloride is also recommended. Intestinal actinomycosis with localized pus foci necessitates laparotomy and, in the cerebral type, if the symptoms suggest a localized abscess, surgical interference is also indicated.

BLASTOMYCOSIS.

Definition. A chronic inflammatory disease characterized by various lesions, particularly of the skin, and due to infection with a fungus of the yeast variety termed *blastomycetes*.

Ætiology. As stated above this affection is the result of the action of the specific fungus, which is a rounded, ovoid or irregularly shaped body possessing a homogeneous capsule and made up of finely or coarsely granular protoplasm which sometimes contains a clear vacuole of varying size. The fungi may be obtained from the diseased tissues and from the pus of the blastomycetic abscess. Organisms from different patients often differ in their cultural behavior, consequently it is very possible that this type of fungus may later be differentiated into separate classes.

Among the first blastomycetic infections to be observed were those affecting the skin; here previous traumatism seems, in some instances, to have been a predisposing factor in the ætiology. Involvement of the various viscera has followed the skin infections in some instances, while in others the organism seems to have effected its first entry by means of the lungs. In the skin infections, the lesions being in the form of subcutaneous miliary abscesses, it is easy to account for the subsequent visceral involvement, for here the infection probably is carried by means of the blood or the lymph circulation. Primary pulmonary infection doubtless follows the inhalation of the fungus, and its lodgment and subsequent development in the bronchial tract ensues.

Pathology. The skin in this affection exhibits lesions similar to those of tuberculosis verrucosa cutis; there are purplish elevated areas which are soft and spongy and from the bases of which drops of pus may be expressed; there may also be small raised nodules not larger than a pea and reddish in color. Microscopic sections show epithelial hyperplasia, tiny intra-epithelial abscesses, a granulomatous condition of the corium, and the presence of the specific fungus.

The lung of pulmonary blastomycosis is characterized by a surface studded with grayish-white or yellow nodules; these are firm in texture, are slightly elevated and resemble miliary tubercles. Both lungs are usually involved but often not to an equal extent. There may be pleuritic adhesions. Section of the lung shows a fairly uniform distribution of the nodules throughout the pulmonary tissue; a tendency to the formation of clusters is not unusual. The lung structure between the nodules appears normal. The miliary bodies are yellowish at their centers and upon being squeezed exude a small amount of pus; they are situated in the connective tissue surrounding the bronchi and the blood-vessels.

Symptoms. These vary with the situation and number of the lesions but, since in all reported instances of generalized blastomycosis the pulmonary manifestations have been most prominent, the symptomatology is chiefly referable to the lungs. Cough is constant but variant in intensity and frequency; rarely it may be so slight as to attract no attention. Expectoration is usually present. It may be purulent, muco-purulent or blood stained; the blood probably results from the severity of the effort of coughing, for there is

no tendency to the development of cavities. Fungi may be demonstrated in the sputum. Dyspnœa may be present, differing in degree with the extent of the lesions; the respiration and pulse are usually accelerated. There is generally a rather constant elevation of temperature, dependent, as in tuberculosis, upon the presence of septic bacteria and upon the absorption of their products. Temperature of pyæmic type has been observed. Chilly feelings and sweating occur when there is a mixed infection.

Physical Signs. These are in no way characteristic, but dulness and bronchial breathing over the lesions are usually present.

The diagnosis depends upon the demonstration of the specific fungi in the sputum and upon the presence of the typical skin lesions.

The prognosis. The disease may last for months or years but is probably ultimately fatal in all instances.

Treatment. The nursing, diet and general hygiene of the patient should be conducted upon the same lines as those applicable in pulmonary tuberculosis, and the sputum should be properly disinfected. Just as in pulmonary actinomycosis the drug which is our chief stay is potassium iodide; large doses should be employed, the usual amount being from one drachm (4.0) to one and a half drachms (6.0) daily. The iodine is said to cause a destruction of the tissues about the fungus in actinomycotic growths with the result that the organism may be discharged if a clear exit is provided and it is possible that a similar process may take place in blastomycetic infections. The employment of X-ray exposures is said to increase the absorption of the iodine, consequently the ray may be employed in connection with the administration of the iodide. Exposures have been made as frequently as every two days, but in the present status of our knowledge of the possible evil effects of this form of treatment it should be given by none but those who are expert in its manipulation and even then with great care.

The inhalation of the vapor of copper sulphate solution from a nebulizer or in the form of steam has been suggested on account of the destructive action that this substance is known to possess over certain vegetable growths, notably algæ. The spray should not be so strong as to irritate the linings of the respiratory tract, but it should be used as continuously as possible.

Subcutaneous abscesses should be incised and drained; if extensive lesions are demonstrated in the lungs these also may be treated surgically; the wounds should be allowed to remain open, in order to allow free exit to the infectious matter which may be assisted by the administration of potassium iodide.

EPIDEMIC STOMATITIS.

Synonyms. Foot and Mouth Disease; Aphthous Fever; Aphthæ Epizooticæ.

Definition. An acute infectious disease of animals most frequently seen

in cattle, sheep, and pigs, occurring rarely in dogs, cats and fowls, and characterized by the presence of vesicles and ulcers upon the buccal mucous membrane, in the clefts about the feet and upon the udders. It may occur in epidemics, when it spreads with great rapidity and may entail considerable loss to the grazing interests. The infection is transmissible to man.

Ætiology. The disease occurs in human beings as a result of drinking the milk or, more rarely, of eating cheese or butter from infected cattle, and through contact with the contents of the vesicles in the mouths or upon the teats of the diseased animal. Meat from such animals does not appear to be infective. No micro-organism has yet been demonstrated to be responsible for this disease and, while it may be of microbic origin, the specific cause is probably too small to be visible through the microscope since the contents of the vesicles retains its infective properties after passage through a porcelain filter which is impermeable to the most minute bacteria. Animals may be rendered immune by a vaccine elaborated by Löffler.

Infants may be infected by milk from diseased cows and a connection has been suggested between the aphthous stomatitis of children and foot and mouth disease.

Symptoms. After an incubation period of from three to five days the onset is marked by a rise in temperature, malaise, anorexia and digestive disturbance; these may be preceded by a chill or chilly sensations. Vesicles containing a yellow serum appear upon lips, tongue and pharynx; the mouth is hot, its lining is red and swollen and there may be interference with speech and deglutition; the saliva is increased. An eruption of vesicles, which may become pustules, appears upon the skin particularly of the fingers and toes, about the nipples in women and at times over other parts of the body. This rash may be mistaken for that of smallpox or for vaccinia if it occurs after vaccination. The vesicles within the mouth may go on to ulceration.

The prognosis is good except in young infants.

Treatment. Prevention consists in boiling all suspected milk and insistence upon cleanliness in the care of animals.

The diseased mucous membrane should be kept clean by means of simple antiseptic mouth washes of potassium chlorate, boric acid or liquor antisepticus. The ulcers should be powdered with burnt alum or, if this is inefficient, touched with stick silver nitrate. The cutaneous eruption necessitates the employment of mild lotions of 1 to 5 or 10,000 mercury bichloride solution and of dressings of sterile gauze. In other regards the treatment is wholly symptomatic.

MILK SICKNESS.

Synonyms. The Trembles; The Slows.

Definition. An acute infectious disease of man and the lower animals

formerly common in the Western states and at present sometimes seen in North Carolina, Ohio, Indiana, Kentucky, West Virginia and Michigan. In animals it is termed "the trembles."

Ætiology. The disease is most frequently observed in newly settled lands and seems to disappear as the ground is cultivated and the forests are cleared. Its specific cause is not known but the infection is probably transmitted to man through the milk, cheese and butter, as well as by the means of the flesh, of diseased animals. The contagium may have its origin in the soil and a spirillum has been found in the blood of sufferers, but this as yet has not been proven to be a distinct ætiologic factor.

Pathology. No characteristic morbid changes have been described, few autopsies upon human beings having been performed.

Symptoms. After an indefinite incubation period and prodromal symptoms lasting a few days and consisting of increasing malaise, headache and loss of appetite, the onset of the disease occurs. This is sudden and marked by nausea and regurgitant, never fœcal, vomiting, gastric pain, obstinate, sometimes absolute constipation, thirst and moderate rise of temperature. The mouth is dry, the tongue tremulous and swollen and the breath is foul and it and the patient possess a characteristic odor. The pulse is at first full and rapid, later the typhoid state may supervene, when it becomes small and weak, and pronounced cerebral symptoms appear. Convulsions may be noted. The severer and more acute infections may terminate fatally within a few days, in other instances the disease may be protracted for three or four weeks.

The diagnosis is usually made by exclusion and upon the fact that "the trembles" is prevalent among the cattle of the neighborhood.

The prognosis is unfavorable, the disease generally proving fatal.

Treatment. Prevention consists in the avoidance of all possibly infected milk, meat or other foodstuffs. The treatment is symptomatic and eliminative; the administration of 10 to 15 grains (0.66 to 1.0) of ground calcined deer horn every six hours is suggested. Calomel should not be given as a purge; castor oil or magnesium sulphate is preferable. Stimulation is usually necessary, here alcohol, strychnine, etc., may be employed. The diet should be arranged in accordance with the principles usual in infectious diseases.

GONORRHŒAL INFECTIONS.

The consideration of infection of the male urethra and of the vagina with the gonococcus is without the scope of this work but this fact does not render less the importance of the disease. Gonorrhœa is without doubt one of the greatest scourges with which the human race has to contend and its effects reach far beyond the seat of the primary inflammation. The extent of the

ravages of the infection are prominently brought to notice by the recent statement of an eminent gynæcologist that probably not less than 80 percent. of the married women of New York City are suffering from pelvic disorders of various characters, the result of infection from their husbands whose youthful or later indiscretions become thus responsible for ills that render a woman's life miserable and end in sterility or even more serious conditions. The time is past when a specific urethritis is to be looked upon as little more grave than a cold in the head and considered a part of the education of every young man. It has been demonstrated that the gonococcus remains active in the urethral discharge long after this ceases to be purulent in character and even after years, when the host of this insidious organism believes himself wholly cured, is capable of as much mischief as when the infection was in its early stages.

GONORRHŒAL SEPTICÆMIA AND PYÆMIA.

These conditions do not differ, so far as symptoms are concerned, from analogous states resulting from other microbic infections, except that they are associated with genito-urinary inflammations. The gonococcus may be demonstrable in the blood and the course of the affection varies in severity. The irregular temperature may continue for a number of weeks and, unless the endocardium becomes involved, recovery may take place; on the other hand rapidly fatal infections occur usually associated with localized pus collections in different parts of the genito-urinary system.

The most important and frequent local manifestations of general gonorrhœal infection are gonococcal endocarditis and arthritis.

a. **Gonorrhœal endocarditis** is a serious condition and for its more complete discussion the reader is referred to the section upon malignant endocarditis (p. 569). Gonococci may be demonstrated in the blood and in the ulcerations or verrucous growths upon the valves. Other cardiac lesions such as pericarditis and myocarditis may be associated with the endocardial inflammation.

b. **Gonorrhœal arthritis** is a septic inflammation of a joint due to the gonococcus. It is not an uncommon sequence of gonorrhœal infection and is serious in its effects. It usually occurs during the attack of a gonorrhœal infection of the urethra or vagina but has been observed to follow gonorrhœal conjunctivitis in children. It seems to be more common in men than in women and may not appear until late in the attack or even during the chronic stage of the infection. One or more joints may be attacked and the inflammation at times involves articulations seldom affected by acute articular rheumatism, such as the inter-vertebral, temporo-maxillary, sterno-clavicular, etc.

Pathology. The morbid changes present are by no means uniform.

The inflammation may involve the tissues without the joint and spread along the tendon sheaths or it may be intra-articular. In each case the synovial membranes are affected and pus may or may not be present. From the exudate the gonococcus may be grown and this organism is at times associated with the common bacteria of suppuration.

Symptoms. A number of different clinical varieties of gonorrhœal arthritis have been described but it will suffice to mention two principal types, the acute and chronic.

a. Acute gonorrhœal arthritis differs in severity in different instances. It may be evidenced only by slight pain and stiffness or in the more acute infections, one or more joints may become suddenly involved in severe inflammation with pronounced pain, tenderness, redness and swelling. Intra-articular fluid may be demonstrable upon palpation. If the exudate is purulent constitutional symptoms are usually present. In the extra-articular form the inflammation is prone to extend along the sheaths of the tendons. The symptoms are persistent and ankylosis, more or less marked, may follow.

In general gonorrhœal infection suppurative arthritis and endocarditis may co-exist.

b. Chronic gonorrhœal arthritis. In this condition there may be a serous joint effusion or a chronic inflammatory process may involve the intra- and extra-articular structures; in the former condition there may be little or no pain but in the latter pain is usually present and is associated with swelling extending to some distance above and below the joint.

Gonorrhœal arthritis is especially prone to affect the knees, wrists and ankles and relapses are frequent. Its course is often protracted and obstinate.

Complications are not rare and may be serious. Iritis, pericarditis, myocarditis, endocarditis, pleurisy and septic pneumonia have been observed.

The diagnosis, when there is present a urethral discharge, is simple, but in other instances must be based upon the presence of gonococci in the blood or in the articular effusion. In the acute form the pain is more severe and the tendency to peri-articular involvement greater than in acute articular rheumatism; the latter is said to be more likely to affect several joints in succession while an arthritis of a single joint is to be considered as more probably of gonorrhœal origin.

Treatment consists first in the employment of local measures with the intent of curing the local genital inflammation if this is present. In general constitutional infection iodine is the most reliable agent and good results may be obtained by the administration of the syrup of hydriodic acid in doses of ½ an ounce (15.0) half an hour before meals in two ounces (60.0) of water. The mode and time of administration are important since the drug is somewhat irritant to the stomach. If not well borne 10 percent. of *resublimed*

iodine in oil of sesame may be employed in doses of 10 to 20 minims (0.66 to 1.33) every three hours. Iodine so given is taken into the blood stream as is proven by the fact that the saliva gives the starch-iodine reaction within 20 minutes after the administration of a dose *per rectum*. The above treatment is also to be prescribed in gonorrhœal arthritis and endocarditis in connection with inunctions of colloidal silver ointment (unguentum Credé), ½ an ounce (15.0) into each affected joint three times a day. Within 6 to 10 days after the commencement of such treatment a noticeable improvement in the arthritic symptoms should be apparent.

Syrup of iron iodide in doses of 10 minims (0.66) to one drachm (4.0) three times a day has also been recommended and the internal administration of the preparations of mercury has its advocates. The salicylates seem to be wholly useless.

Favorable results have been reported from the treatment of gonorrhœal arthritis by means of Bier's method of passive congestion. The technique of the treatment consists in the application of an Esmarch bandage just long enough to encircle the limb two or three times at the desired tension and provided with strap and buckle at either end. The bandage is applied just above the affected joint and is secured when the desired degree of congestion has been obtained. The skin may be protected by a few turns of an ordinary bandage, and to avoid stasis in parts where it is not needed, that part of the limb which lies peripherally to the infected area may be snugly bandaged. The congested limb should not be allowed to become cold to the touch and the patient should not be made uncomfortable. The congestion should be continued for from 10 to 12 hours at a time and, while the strap is off, the limb should be elevated to reduce the œdema which the constriction has produced. Upon the subsidence of acute symptoms, massage and passive motion should be instituted. In general the duration of the stasis should depend upon the effect obtained. If the pain is relieved in an hour or two and motion becomes less difficult, this length of time is sufficient, but if the symptoms soon return a longer application of the bandage is necessary. In the chronic effusion following acute inflammation this form of treatment is useless.

With regard to local treatment other than that by the silver inunctions, absolute rest of the affected joints is to be insisted upon and it may be advisable to apply a splint. This, however, should not be allowed to remain in place long enough to cause ankylosis. The continued application of a 10 percent. ichthyol ointment in the intervals of the silver inunctions may assist in the relief of pain.

The more chronic forms of joint involvement may be relieved by counter-irritation by blisters or the thermo-cautery, baking in the hot air apparatus is to be recommended and the absorption of the effusion may be facilitated

by massage and passive movements. These last also are an excellent means combating the tendency to ankylosis.

Constitutional treatment by means of iron, arsenic, quinine and strychnine is important, especially in the chronic infections.

Surgical treatment, consisting of opening the joint, evacuating the effusion and irrigating with mild antiseptics or sterile saline solution, has its advocates and in many instances has achieved excellent results.

SYPHILIS.

Synonyms. The Pox; Lues Venerea.

Definition. A specific constitutional disease of slow course resulting from inoculation or from hereditary transmission. The disease, when inoculated, is known as acquired syphilis and, when conferred by inheritance, as hereditary syphilis. In the acquired form there appears at the site of inoculation the so-called initial lesion or chancre which is usually an ulcer possessing special characteristics. This is followed within a month or two by constitutional manifestations and lesions of the skin and mucous membranes, the symptoms of the secondary stage, and after months or years by gummatous growths in the various tissues and organs, the tertiary lesions, and finally there may appear various morbib conditions in the nervous system such as locomotor ataxia and general paresis, which are known as quaternary lesions.

Ætiology. While several micro-organisms have been described, which have been thought responsible for this disease, their connection with the infection has not yet been definitely proven. Recently Schaudinn and Hoffmann have drawn attention to micro-organisms of the genus spirochæta, which they have found in primary and secondary syphilitic lesions, both at their surfaces and in their deeper parts and in the adjacent lymphatic glands. The former observer considers that the spirochætæ are related rather to the protozoa than to the bacteria and must, therefore, be clearly distinguished from the spirilla. He describes two varieties, one found only in syphilitic lesions, the other, saprophytic in nature and constantly met in stagnant secretions such as those occurring about the genitals. The former is termed the *spirochæta pallida*, the other the *spirochæta refringens*. The former is much the smaller and is seen only with the higher powers of the microscope and even then, with difficulty.

Metchnikoff and Roux have found identical forms in experimental syphilitic lesions in monkeys and other observers have wholly confirmed the work of Schaudinn and Hoffmann. The spirochæta pallida has been found in the blood and organs of infants suffering from congenital syphilis and in acquired syphilis in the blood procured by splenic puncture on the day before the roseolar rash appeared, proving that it reaches the skin through the blood-

vessels. Later it has been demonstrated in the circulating blood. In acquired syphilis it is found only during the primary and secondary stages, practically never during the tertiary. Most authorities agree that the spirochæta is never to be found in non-syphilitic lesions, one or two have, however, encountered it in other conditions. The balance of evidence seems to favor the ætiologic relation of the spirochæta pallida to syphilis and the most conservative admit that it probably plays some part in the causation of the disease.

Syphilis is an extremely contagious disease but a solution of the continuity of skin or mucous membrane is necessary to its inoculation. The secretions of the primary and secondary lesions as well as the blood of the syphilitic patient are capable of transmitting the infection but the authorities differ as to whether the products of the tertiary manifestations, the gummata, are infectious. It is probable, however, that they are. Normal secretions, such as milk, tears, etc., unless contaminated by the secretions of specific lesions, are not capable of conferring the disease. The spermatozoa or ova of syphilitic individuals are, however, infectious.

In most instances the acquired form of the disease results from sexual congress but the infection may be acquired innocently through the use of infected drinking cups or other utensils, by kissing, by the physician during operation or while handling infected patients, and in various other ways. The wet nurse may be infected by the syphilitic child, the initial lesion appearing upon or near the nipple and the disease has been transmitted by vaccination with humanized virus.

Hereditary specific disease is most commonly transmitted through the father in which case it is termed sperm infection. A syphilitic father may beget diseased offspring during the tertiary stage when all symptoms seem to have disappeared but he is most likely to beget a syphilitic child soon after the beginning of his infection; on the other hand the child of a syphilitic father may show no evidence of the disease when begotten during the tertiary stage or even when begotten while the disease is at its height. No certain assertion can be made that a father once infected with syphilis will not transmit the disease to his children but it may be stated that the greater the period since the occurrence of the initial lesion, the less likely are the children to be affected. At least three years, during which the individual should undergo proper treatment, should elapse between the initial lesion and marriage.

Syphilis transmitted through the mother is termed germ infection and is more likely to prove fatal than sperm infection. A child may also be infected during its passage through the parturient canal or, the mother acquiring the disease during pregnancy, the child may escape or may become infected through the placenta. It is a curious fact (Colles' law) that a syphilitic infant born of a non-syphilitic mother cannot transmit the disease to her, even though she nurse it while there exist syphilitic lesions upon its lips or within

its mouth. This is probably due to an immunity possessed by the mother and which has been conferred without the manifestation of any symptoms whatever.

Children born of parents, both of whom are syphilitic, are very unlikely to escape the disease.

Pathology of acquired syphilis. The lesions of this form of the infection occur in stages, the first being that of the primary lesion or chancre. This appears at the site of the inoculation and usually about three weeks after this occurrence. At first it consists of an abrasion upon which a papule or vesicle appears; later this disintegrates at its center and an ulcer results, the base and edge of which are firm and indurated. It varies in size and may be unnoticed if it occurs within the urethra and is especially likely to be overlooked in the female. In the male it is usually upon the penis and frequently upon the prepuce, while in females a frequent site is upon the labia or upon the cervix. Microscopically the indurated tissue is found to be the result of an infiltration of the connective tissue with small round cells, some of which may later become epithelioid or even giant cells. The intima of the vessels is thickened and the nerve fibres may be the seat of pathological change. The neighboring lymph ganglia are enlarged, hardened and may suppurate.

The lesions of the secondary stage consist of a cutaneous eruption or syphilide. This rash occurs in a variety of different forms, macular, papular, pustular, squamous and tubercular; the hue of these is characteristic and may be described as ham or copper color. The macular syphilide usually lasts one or two weeks and is especially apparent upon the chest, abdomen and flexor surfaces of the arms; the papular eruption occurs upon the face as well as upon the body, and like the others, tends toward a symmetrical distribution. The pustular rash is not unlike that of variola and the squamous syphilide possesses nothing typical except its color; it is a rare form and its favorite situation is upon the extensor surfaces of the limbs. All forms of the eruption are characterized by a tendency to symmetrical distribution and to leave behind a more or less permanent discoloration.

With the cutaneous manifestations an involvement of the mucous membranes and of moist skin surfaces occurs; this is termed the mucous patch or broad condyloma (*condyloma latum*). These appear upon the buccal and pharyngeal mucous membranes and at the muco-cutaneous junctions about the lips, anus, etc., and consist of a cellular infiltration of the epidermis and corium. The mucous patch is a flat or slightly convex pearl colored elevation, with a surface resembling mucous membrane, the secretion of which is highly contagious. The condylomata are exaggerated mucous patches and consist of rounded discs, reddish or grayish in color, granular of surface and slightly elevated. The secretion of these is also pronouncedly infectious. The

venereal wart or *condyloma acuminatum* is also a manifestation of the secondary stage.

The lesions of the third stage may involve any of the deeper tissues or organs and consist of discrete tumors (gummata). These are usually firm in consistency and vary in size from that of a pin point to a diameter of from one to two inches (3 to 5 cm.). On section they are seen to consist of a central area, firm and caseous, surrounded by a layer of fibrous tissue outside which is an external layer of cellular granulation tissue.

Such gummata are common in the skin, muscles, periosteum, bone—where they are termed nodes—and in the connective tissue of the brain and viscera. When situated in submucous tissues ulceration or suppuration may result with destruction of tissue, such as is observed in syphilitic disease of the nasal or palatal bones.

Arterial changes also occur as a result of tertiary syphilis. These will be considered in the section devoted to arterial disease (p. 606).

Symptoms of acquired syphilis. These occur in stages and are intimately associated with the morbid changes above described. The incubation period of the disease is usually about three weeks, that is to say about this time intervenes between the inoculation and the appearance of the primary lesion or chancre. This and the associated glandular enlargements have been considered.

The symptoms of the secondary stage usually appear in from 6 to 12 weeks. First there is a pharyngeal congestion with soreness of the throat. Sluggish ulcerations of a gray color are seen upon the mucous membranes of the throat and larynx, those in the latter situation being likely to cause deformity of the part upon healing. Mucous patches and condylomata may be present. There is usually a moderate febrile movement which seldom rises higher than 101° F. (38.3° C.) although temperatures of 104° to 105° F. (40° to 40.5°C.) have been observed. The temperature is usually continuous or remittent; less frequently it is intermittent and may be mistaken for malaria. The pharyngeal inflammation may involve the middle ear by extension through the Eustachian tube.

Cutaneous lesions now appear; the most frequent is the macular syphilide previously mentioned. The rash lasts for two or three weeks and may be followed by other forms of the syphilitic eruption. Recurrences of the rash may occur at intervals even as late as 11 years after the initial lesion. The hair often falls and there may be a syphilitic onychia. Iritis is common and may be serious. Choroiditis and retinitis are more rarely observed. Joint symptoms, at times so marked as to suggest acute articular rheumatism, and pains in the limbs are not unusual. Jaundice, nephritis, parotitis and epididymitis may occur. Anæmia is very common.

The tertiary stage cannot be distinctly separated from the secondary.

During this stage the characteristic manifestations are various cutaneous eruptions, amyloid degenerations and involvement of the viscera by gummy tumors.

The tertiary syphilides are usually deep seated, tend to ulcerate and may subsequently heal, leaving scars. They may be scattered over the body and are seldom symmetrical. Syphilitic rupia consists of pustules, ulcerated at the base and covered by a laminated crust.

Hereditary syphilis may be evidenced by all the morbid changes and symptoms which are met in the acquired lues except the primary lesion. Still-births and abortions are very frequent consequences of fœtal syphilis but the appearance of the newly-born syphilitic child is often that of health, the syphilitic manifestations appearing after a month or two; at other times the subject of syphilitic inheritance is poorly developed, ill-nourished and shriveled in aspect; skin eruptions are frequent and the so-called pemphigus neonatorum, a bullous rash about the wrists and ankles, hands and feet, is typical. The liver and spleen are enlarged, the lips are wrinkled, fissured and ulcerated and the child snuffles; the discharges are infective and may be sero-purulent or sero-sanguinolent; bone necrosis at the bridge of the nose may lead to the characteristic deformity. Bony nodes may be present upon the skull (Parrot's sign). Middle-ear involvement may take place through the Eustachian tube. If the child is apparently healthy at birth the above described symptoms may appear up to the sixth month.

The cartilages of the ribs and those of the epiphyses of the long bones are very commonly affected and even epiphyseal separation may take place. The child nurses poorly, is restless and a typical cry, described as harsh and high-pitched, has been observed. Hæmorrhages into the skin, from the mucous membranes or from the umbilicus (*syphilis hæmorrhagica neonatorum*) are a rather rare manifestation.

If the child survives its growth it is stunted and is likely to present the appearance of premature age. Under proper treatment recovery may take place and, while development may be delayed, the disease may not give further symptoms. As a rule, however, further syphilitic manifestations appear at the time of second dentition or at puberty. The subject of hereditary syphilis who survives childhood is under-developed and looks younger than his age (infantilism), the frontal region is prominent, the frontal bosses protrude, the bridge of the nose is depressed (saddle-nose) and its tip turned up. Cranial asymmetry may be present and the teeth are notched (Hutchinson teeth). Those particularly affected are the upper central incisors which are peg-shaped and notched at the edges, the enamel often being wanting over the notches.

Amongst other manifestations which are late in appearance are bone deformities, especially of the tibiæ which are thickened and curved antero-

posteriorly, the convexity being forward; nodes may be present upon the bones; interstitial keratitis, iritis, syphilitic deafness and gummata of the nervous system or of the viscera may be observed.

The diagnosis of syphilis is not difficult in the presence of a history of exposure or of heredity. There may be difficulty in deciding upon the character of the initial sore, consequently it is well to wait until the appearance of secondary lesions before beginning treatment. The test of treatment by mercury and iodine will usually clear the diagnosis in doubtful cases.

Justus' test consists in first estimating the hæmoglobin content of the blood, then ordering a mercurial inunction or injection and subsequently making a second hæmoglobin estimation. In instances of syphilis there will be a reduction of from 10 to 20 percent. This test is based upon the fact that mercury causes a destruction of the hæmoglobin which is rapidly replaced under normal conditions. In the syphilitic subject, however, this power of reproduction is greatly diminished.

The prognosis in acquired syphilis under early and proper treatment is good but the length of time necessary to assure a cure is at least two years; consequently syphilitics should be strongly advised against marriage within two years after the appearance of the initial lesion; if active symptoms remain at the end of this period marriage should be forbidden as long as these persist. Even in individuals who have undergone thorough treatment it is not unusual to observe late complications referable to the nervous system. The prognosis of infantile syphilis is not so good as that of the infection in adults and hereditary infantile syphilis is much more grave than that acquired after birth. Even the subjects of hereditary syphilis who survive are rendered so weak of constitution by the disease that they fall an easy prey to even slight intercurrent affections.

Treatment. The prophylaxis of syphilis acquired through illicit intercourse can only be instituted by insisting upon the absolute importance of sexual purity. The physician who advises the performance of the sexual act under illegitimate conditions cannot be too strongly condemned. The young man who finds his fleshly lusts too vigorous to be denied may do much to subjugate them by working hard physically and mentally.

Practitioners associating with syphilitics in a professional capacity cannot be too guarded in their handling of specific lesions.

Much may be done toward the prevention of hereditary syphilis by treating the mother during pregnancy if she has ever been affected with the disease or if the father is syphilitic. Syphilitic lesions of the genital tract should be cleansed and cauterized previous to labor. Should the child be born healthy it should never be nursed by a suspected mother or wet nurse, it should not be kissed by nor sleep with diseased parents and the greatest care should be exercised in rendering utensils and other objects with which the child comes

into contact above reproach. No syphilitic child should be allowed to nurse from a healthy woman.

The treatment of the primary lesion consists in the endeavor to heal it as soon as possible. This is to be accomplished by simple cleanliness. The sore should be washed with a 1 to 2 or 3,000 mercury bichloride solution several times daily and kept dusted with equal parts of bismuth and calomel, iodoform—which should be used with care since an idiosyncrasy to this drug is not rare—or other bland antiseptic powder. A dressing of mercurial ointment may also hasten the healing process. Cauterization or excision of the lesion is useless

The secondary lesions should also be treated by the application of cleansing agents. The teeth should be frequently brushed and a mouth wash of ½ saturated solution of potassium chlorate, which not only has a beneficial effect upon the mucous patches but is prophylactic against mercurial stomatitis, should be frequently employed. The use of tobacco and alcohol should be forbidden. Ulcers should be cleansed with the mercury bichloride solution, dressed with mercurial ointment or dusted with calomel and, if necessary, touched with silver nitrate stick or solution; the latter may also be employed upon the mucous patches in the mouth. Condylomata should be kept thoroughly cleansed and either dusted with the powders mentioned above or dressed with mercurial ointment.

Constitutional treatment should be instituted as soon as the diagnosis is assured and consists in the administration of mercury during the secondary stage and of iodine during the tertiary. The two may often, however, be given together with advantage during the second stage. Mercury may be administered in various ways; of these one of the best and one of the most commonly employed is by inunctions. Its disadvantages are that it takes considerable care and time and is not cleanly. The plan is as follows: The patient should take a warm bath daily to cleanse the skin and render it more capable of absorption. After the bath a drachm (4.0) of the official mercury ointment is thoroughly rubbed into the skin, the friction to be continued until the ointment has entirely disappeared. It is well to choose a different site for the inunction each day, first taking the inside of one thigh, next that of the other, the inner aspect of the arms, then the sides of the chest, etc. When these parts have been exhausted the list should be begun again. The rubbing should last at least ½ hour. Hairy parts should be avoided, since the follicles offer favorable foci for the beginning of a mercurial eczema, and the use of a potassium chlorate mouth wash is necessary to prevent stomatitis. Should this occur, as evidenced by soreness of the gums and teeth, foul breath, etc., the inunctions should be stopped for a week or more until the buccal symptoms disappear. The frictions should be continued for about a month, when, if the syphilitic symptoms have subsided, they may be

omitted and internal treatment begun. Here mercury may be given in various forms, the preparations most usually employed being the yellow iodide (protiodide) gr. $\frac{1}{4}$ (0.016), the red iodide (biniodide) gr. $\frac{1}{6}$ (0.004) or the bichloride gr. $\frac{1}{12}$ (0.005) three times a day. If the patient can be made to understand how essential continued treatment is the tertiary manifestations may be prevented from making their appearance. To accomplish this desirable object, however, the treatment must be continued for an indefinite period.

Various substitutes for the inunction method of treatment have been advocated and the one most in use at present is that by hypodermatic injection of various mercury salts. The injections are given by means of a long needle attached to the ordinary hypodermic syringe, the solution is thrown into the deeper muscular structures and the procedure must be carried out under the most thorough aseptic and antiseptic precautions. The sites usually selected are the buttock, the sides of the thorax or the flanks. Such solutions as the following may be employed: Mercury bichloride 0.2 parts, sodium chloride 2 parts, distilled water to 20 parts. Of this a daily injection of 15 minims (1.0) may be given. Mercury benzoate 0.25 parts, sodium chloride and cocaine hydrochloride of each 0.06 parts, distilled water to 30 parts; peptone and ammonium chloride of each 0.3 parts, mercury bichloride 0.2 parts, glycerin 5 parts, distilled water 15 parts; neutral mercury lactate 1 part, distilled water 100 parts; mercury cyanide 0.1 part, distilled water 20 parts; mercury salicylate 4 parts, benzoinol 30 parts; of all the above the dosage is 15 minims (1.0) which may be injected daily. In very grave infections the dosage may be doubled or 15 minims (1.0) of a 1 percent. mercury cyanide solution may be introduced slowly, directly into a vein; a mixture of calomel $1\frac{1}{2}$ parts and sterile oil 15 parts may be given subcutaneously in doses of 15 minims (1.0) about once a week. The treatment by injections is especially indicated when it is necessary to mercurialize the patient without delay, in patients whose skin is badly affected by inunctions and the internal administration of mercury disturbs the digestion and in instances where the disease resists other methods.

Mercurial fumigations have had a certain vogue. The patient, sitting on a chair, is surrounded to the neck by blankets arranged in the form of a tent. An alcohol lamp is placed under the chair and upon this is set a metal plate containing about $\frac{1}{2}$ drachm (2.0) of powdered calomel. The seance should last about 20 minutes during which the calomel is volatilized by the heat of the lamp and it, with the steam from a vessel of water also placed over the lamp, is absorbed by the patient's skin. This treatment affects favorably both the constitutional symptoms and the eruption. Calomel vapor when inhaled, the mouth being held about 20 inches from the containing vessel, often exerts a favorable influence upon the mucous patches. After

the inhalation the mouth should be thoroughly washed to prevent salivation.

Hutchinson prefers to give mercury with chalk (*hydrargyrum cum creta*) in pill form, each pill containing 1 grain (0.065) each of this preparation and Dover's powder; one pill to be taken from 4 to 6 times a day. Most excellent results are said to be obtainable from this form of treatment.

While undergoing mercurial treatment the patient should be forbidden to eat fruit and green vegetables.

Instances are often met in which greater benefit is achieved by the alternate administration of mercury and iodine or by giving these drugs in combination, the so-called "mixed treatment." Those in which this form of treatment is particularly indicated are the cases with dry tubercular syphilides, cases with the syphilitic rupia, those with choroiditis, onychia, periostitis and cerebral syphilis. The following formula will be found useful: ℞. Hydrargyri iodidi rubri, gr. iii (0.2); potassii iodidi, ʒii ss (10.0); syrupi simplicis, q. s. ad, ʒiv (120.0). Misce et signa, one teaspoonful two or three times daily.

The potassium iodide in this formula may be increased as indicated. Another useful prescription is composed of mercury bichloride two grains (0.13), potassium iodide three to five drachms (12.0 to 20.0) and distilled water and compound syrup of sarsaparilla equal parts up to four ounces (120.0). Here the combination of potassium iodide with mercury bichloride results in the production of a certain amount of red mercuric iodide which is dissolved in the excess of potassium iodide. The mixed form of treatment has been considered especially effective in the intermediate period of the disease when the secondary stage is passing into the tertiary. It is also indicated in instances of syphilitic hepatitis and in the presence of the ascites of this condition the so-called Guy's diuretic pill which is composed of 1 grain (0.065) each of powdered digitalis, squill and calomel may be prescribed with benefit.

In the third stage of syphilis iodine, administered in the form of the iodides and particularly potassium iodide, produces results which cannot be accomplished by any other means, the rapid absorption of nodes, gummata and other deposits quite frequently being brought about. In order to secure the best effect it is necessary to give very large amounts in many instances, two to four drachms (8.0 to 16.0) being not an unusually large daily dosage. In syphilis of the nervous system especially large doses are called for and daily amounts of 1 ounce (30.0) are not infrequently required. The drug may be administered in saturated aqueous solution, in milk or in the compound syrup of sarsaparilla beginning with 10 drops (0.66) three times a day and increasing the doses 1 drop (0.065) daily until the disease is controlled. Should the symptoms of iodism appear—nasal discharge, an erythematous eruption, increased secretion of saliva and swelling of the salivary glands causing a sense of tightness in the throat—the drug should be stopped or the dose diminished until these disappear. It has been advised to enlarge

the beginning dose to 30 to 40 minims (2.0 to 2.66), since, when given in this way, the drug has seemed less likely to cause toxic symptoms. Another most excellent method of giving iodine is in the form of the syrup of hydriodic acid. The dosage of this preparation is from 1 to 4 drachms (4.0 to 16.0) three times a day ½ hour before meals and diluted with a wine glass of water. Iodine itself may be administered in capsules each containing from 10 to 20 drops (0.66 to 1.33) of a 10 percent. solution of *resublimed* iodine in oil of sesamum. Strontium and sodium iodide have been suggested as substitutes for the potassium salt since they, especially the former, are pleasanter to take, are less likely to disturb the stomach and to cause toxis symptoms.

It is said that the iodide should be suspended during menstruation if there is any tendency to menorrhagia.

During a course of antisyphilitic treatment the patient should be advised to regulate his mode of life in accordance with strict hygienic principles; fresh air, moderate exercise and nutritious diet are essentials. The eliminatory functions should be kept properly active and co-existent disease, especially tuberculosis or anæmia, should receive appropriate tonic treatment.

The treatment of syphilis at mineral—especially sulphur—springs has no advantage over a thoroughly carried out home treatment. At such places it is perhaps easier for the patient to lead a regular and healthful life and the frequent employment of baths may render the skin more receptive to inunctions of mercury.

The treatment of hereditary syphilis should be instituted as soon as the symptoms of the disease appear or even sooner if the parents give distinct evidence of the disease. Mercury and potassium iodide are as potent here as in adults and may be administered in the same way. Usually the inunction method is preferable. The technique of the treatment has been already described and about 20 grains (1.33) of a mixture of equal parts of mercurial ointment and lanolin or vaseline are employed at each friction. For a child of two years 30 grains (2.0) may be used and at three years of age the dose may be increased to 40 grains (2.66). The inunctions should be continued for three weeks, suspended for a week or ten days and then repeated. The internal administration of mercury should then be begun. Either mercury with chalk 1 grain (0.065) or mercury bichloride $\frac{1}{60}$ of a grain (0.001) four times a day may be given unless it is desirable to mercurialize the patient as quickly as possible when $\frac{1}{10}$ of a grain (0.006) of calomel should be given three or four times daily. Mercury should be continued for a year, with occasional intermissions of a week or more, at the end of which period, mixed treatment may be prescribed. Here we may give a mixture consisting of $\frac{1}{10}$ part of mercury biniodide, 5 parts of potassium iodide, simple syrup 250 parts; this may be given in milk in the following doses. To a child of from 1 to 3 years, 15 to 30 minims (1.0 to 2.0); 3 to 5 years, 1

drachm (4.0); 6 to 10 years, 2 drachms (8.0). The treatment by hypodermatic injections may be employed in instances of digestive disturbance and where the mercurial frictions irritate the skin.

In tertiary infantile syphilis with gummata, visceral, osseous and other lesions, potassium iodide should be prescribed in sufficient dose to meet the indication. The daily dosage for a child of from 1 to 15 months is from ¾ to 3 grains (0.048 to 0.2), from 15 months to 3 years, 3 to 6 grains (0.2 to 0.4), from 3 to 5 years, 7½ to 15 grains (0.5 to 1.0) and from 5 to 10 years, 15 to 45 grains (1.0 to 3.0). The drug should be given well diluted with milk and if it is not well borne the substitutes suggested on p. 154 may be employed.

Antisyphilitic treatment should be continued as long as luetic manifestations are present.

The local treatment of infantile syphilis is identical with that of the disease in adults and it is often of great advantage, particularly if the child's nutrition is poor and anæmia is present, to either intermit the specific treatment for a time or to diminish the dosage, in the meantime giving various tonics, particularly iron, codliver oil and the bitters.

Attempts have been made to elaborate a serum for the treatment of syphilis but up to the present time little or no success has attended these efforts.

TUBERCULOSIS.

Definition. Tuberculosis is an infectious disease characterized by general or local inflammatory processes resulting from the presence and growth within the organism of the tubercle bacillus. The typical lesions consist of nodules or diffuse tissue infiltrations which gradually become caseous, sclerosed, ulcerated or, more rarely, undergo calcification.

Ætiology.—While tuberculosis was considered a disease of infectious character previous to Koch's demonstration of the *bacillus tuberculosis* in 1882, it remained for this observer to prove beyond question its specific origin. Koch's bacillus is a long, narrow, straight or slightly curved bacillus, staining at times irregularly so as to present a beaded appearance. It is found in tuberculous lesions and discharges and in the dust of apartments occupied by affected patients as a result of the drying of unproperly cared for sputum. It is also found in the meat and milk of diseased animals, those most frequently harboring the infection being the bovines; it is rare in sheep and horses but pigs in certain districts are prone to suffer. Tuberculosis is very likely to attack apes in captivity but is unknown amongst them in the wild state.

The bacillus effects entrance into the body in most instances upon the inspired air which may be contaminated by dried sputum or may contain the moist particles which are emitted by tuberculous individuals in coughing,

sneezing and even during conversation. These fine bits of spray have been proven to contain the bacilli. These facts account for the frequency with which those closely associated with subjects of the disease, such as nurses, members of the family, etc., contract the disease, although there is no doubt that by careful attention to cleanliness and proper hygiene this danger can be almost wholly averted.

The contagium may also be taken into the alimentary tract with the food, instances having been traced to the milk, meat and even the butter from infected animals. Food may become contaminated by proximity to tuberculous cooks, bakers, etc., and the milk from a diseased mother may infect her infant, accounting for the occurrence of tuberculosis of the digestive tract in children.

Contact with the excreta of the tuberculous, with the meat of diseased animals, with the lesions of bodies dead from the infection, etc., may cause tuberculosis by inoculation. To the acquirement of the disease in this way the contact of the infective matter with an abrasion of the skin or mucous membrane is necessary.

With regard to the hereditary transmission of tuberculosis it may be said that the disease has been noted in rare instances in the fœtus and that infants have been born with tuberculous lesions; this circumstance also has been observed but seldom. It is a fact that the children of tuberculous parents are more prone to the acquirement of the disease and possess poorer powers of resistance than do those of more healthy heredity.

Other predisposing causes are:

a. Race. The disease is met in all races, the negro and the American Indian, living under civilized conditions, being especially prone to the affection. Hebrews seem to a certain degree exempt, perhaps owing to the peculiar supervision exercised over the meat consumed by them.

b. Age. Tuberculosis may occur at any time of life but certain types seem more common at certain ages than at others, thus pulmonary tuberculosis is most frequent between 20 and 35 while children are particularly prone to the glandular, meningeal and mesenteric forms.

c. Sex. Females appear to be slightly more susceptible than males, perhaps because their duties confine them to the house more than do those of the opposite sex. The progress of the disease becomes more rapid during pregnancy and lactation.

d. Climate. Regions which are subject to dampness and sudden changes of temperature are most favorable to the development of tuberculosis, possibly because under such conditions catarrhal affections are common, these diminishing the resisting power of the body and offering an acceptable nidus for lodgment of the contagium. The disease, however, does occur in all climates.

e. Sanitation. Unhealthful surroundings, overcrowding, lack of fresh air,

and of proper food, and unhygienic occupations, such as those which entail the respiration of dust-laden atmosphere, are distinct predisposing factors.

Further, any acute or chronic disease, particularly catarrhal affections of the respiratory tract, influences which bring about a diminished pulmonary blood supply, congenital or acquired narrowing of the pulmonary artery and other circulatory diseases, predisposes to the occurrence of tuberculous affections. Traumatisms of the thorax, although there may be no injury to the lung itself, also may be followed by pulmonary tuberculosis.

Pathology. The characteristic morbid change is the occurrence in various tissues and organs of miliary tubercules. The most frequent sites for their development are the lungs, liver and spleen; they are also found in the meninges, the bone-marrow, the peritonæum, the heart muscle and the choroid. The tubercles vary from microscopic size to that of a pea and histologically are made up of a number (from 10 to 50) of smaller tubercles. The fact that many of them resemble in size and form a millet seed has led to the term miliary. The tubercle is formed as follows: The bacilli having lodged in a certain tissue act as an irritant, as a result of which there is an emigration of leucocytes from the neighboring blood-vessels; these, with the epithelioid and giant cells, which are produced by proliferation from the cells of the adjacent structures, and with a supporting frame-work of connective tissue, which is most abundant near the periphery, make up the miliary nodule. The bacilli occur within the substance of the epithelioid cells and the giant cells and the fact has been noted that where the latter are most plentiful the bacilli are fewest; accordingly, in lupus, tuberculous joint lesions and adenitis the giant cells are many and the bacilli few, while in pulmonary lesions the opposite condition obtains.

The tubercle also occurs in solitary form; here it is not composed of an aggregation of small miliary bodies but is a single cheesy mass of size varying from that of a pea to that of the fist. It consists principally of round cells in which the bacilli are found; these are supported by a fibrous reticulum and the latter may exist in such amount as to render the entire nodule fibrous in consistency. These single tubercles are found in different situations such as the spinal cord, the liver, the heart, the spleen and especially in the brain in children and are subject to caseous, suppurative and calcareous degeneration.

The Degenerations of Tubercle. Of these the most common is caseation. This begins at the center of the tubercle and is a process of coagulation necrosis of its cells; these gradually lose their outline, their nuclei become indistinct and are no longer demonstrable by staining and finally a structureless granular mass results. The bacilli persist and the cheesy substance resulting may undergo softening, calcification or may become encapsulated by a fibrous wall. The first of these processes is the most frequent and the caseous mass

degenerates into a puriform substance which is not pus, strictly speaking, but which consists of fat droplets, granular matter and disintegrated cells, and contains tubercle bacilli in abundance.

Calcification is less common; here a form of healing takes place by infiltration of the tubercle with calcium salts. Tuberculous deposits in the lymph glands are particularly likely to undergo this change and, exceptionally, it may occur in the lungs.

The sclerotic change in which the tubercle is converted into fibrous tissue consists of a metamorphosis, which, as the disintegration at the center of the nodule takes place, is characterized by hyaline degeneration and increase of fibroid tissue, a firm hard mass resulting; this is a healing process and depends upon the body's power of resistance to the growth and development of the bacilli. It is frequently observed in peritonæal tuberculosis and at times is seen in the lungs.

Secondary inflammatory processes are changes, set up, not in the tubercle itself, but in adjacent tissues by the development of this structure; for instance an overgrowth of connective tissue may result causing a fibroid phthisis or a catarrhal pneumonia. Suppuration is a frequent associate of tuberculous pulmonary inflammation but is the result of a mixed infection with pyogenic bacteria. Whether the tubercle bacillus is capable alone of producing pus is a moot question. Certainly the fluid contents of a cold abscess is not true pus and does not contain the bacteria of suppuration. On the other hand, in tuberculous inflammations of bones and joints, pus is often observed; this, however, may be the result of mixed infection just as is the purulent sputum of pulmonary tuberculosis.

Acute Miliary Tuberculosis.

Synonym. Diffuse General Tuberculosis.

Definition. An acute disease characterized by the presence of numbers of tubercle bacilli in the blood which find lodgment in various parts of the body and there cause the development of miliary tubercles. The disease is, as a rule, secondary to the softening of a tuberculous nodule, usually in the lungs or a lymph gland, and is the result of the dissemination of the bacilli by means of the blood or lymph circulation. The rupture of the nodule may be directly into a blood-vessel, an example of a veritable embolic process.

This form of tuberculosis is most common in adolescents and young adults.

Pathology. In considering acute miliary tuberculosis from its pathologic aspect it is not to be forgotten that it is the result of an old tuberculous lesion. The tubercles which are disseminated through the various tissues in this form of tuberculosis have already been described (p. 157).

Acute tuberculosis occurs in three principal types: 1. With symptoms

pointing to general infection. 2. General infection with pronounced pulmonary symptoms. 3. General infection with marked symptoms referable to the central nervous system.

1. Acute General Miliary Tuberculosis.

Symptoms. These are those of a severe general infection without marked local manifestations and there is great possibility of mistaking the disease for enteric fever. Prodromata, consisting of indefinite malaise, loss of appetite, etc., are common but an abrupt onset with fever may occur; afebrile instances of the disease have occasionally been observed. The pulse is rapid, the tongue dry and cerebral symptoms analogous to those of enteric fever are common. The temperature is usually lower in the morning (101° F.—38.3° C.) and higher at night (103° to 105° F.—39.4° to 40.5° C.), although an occasional reversal of this type of temperature may occur; this is considered an important point in the differentiation of the disease, as is also the fact that the temperature curve, taken as a whole, is more irregular than that of enteric fever and does not present the progressive rise of that affection. Bronchitis may be present but may not be more pronounced than that occurring in typhoid infection. Profuse sweating is common and herpes may be observed; splenic enlargement may be noted and spots resembling those of typhoid fever have been described. The latter, however, do not appear in successive crops.

Early in the disease there are seldom physical signs referable to the lungs other than those of a slight bronchitis, later the respiration may be accelerated and slight cyanosis may occur. As the disease progresses pulmonary and meningeal manifestations may appear. There may also be signs and symptoms of pleuritic, pericardial or peritonæal involvement. Tuberculosis of the choroid may also be noted.

The diagnosis is often difficult, the disease being especially likely to be confounded with enteric fever from which it may be differentiated by its temperature curve, its duration, which is more protracted, the splenic enlargement which appears later and is less pronounced, and by the lack of rose-spots. Cyanosis and accelerated respiration are more frequent in tuberculosis.

In neither disease are the leucocytes increased in number, but upon the incidence of mixed infection, which sooner or later may manifest itself in tuberculous infection, a leucocytosis appears. The examination of the sputum rarely reveals the presence of tubercle bacilli unless the pulmonary nodules disintegrate through the bronchial mucous membrane; they are, however, to be found in the blood, especially that withdrawn from the spleen. When not directly demonstrable, culture and inoculation experiments may reveal their presence.

The absence of the Widal reaction is a valuable point in differentiation.

The urine may contain albumin, usually not as a result of tuberculous kidney involvement, but of the febrile process. Unfortunately the Ehrlich diazo-reaction is often present in acute tuberculosis as well as in enteric fever.

The cerebrospinal fluid, withdrawn by lumbar puncture, may contain tubercle bacilli even though meningeal inflammation is not a feature of the patient in hand.

The prognosis of this, as well as of other forms of acute tuberculosis, is distinctly unfavorable, a fatal outcome being almost inevitable. The course of the infection is usually from four to eight weeks or more, although more rapidly fatal instances have been observed.

Treatment is wholly symptomatic and consists in the administration of proper nourishing food in sufficient quantity, of stimulants as indicated, of antipyretics, such as antipyrine or acetphenetidine—five grains (0.33) repeated as necessary—of sedatives, such as the bromides, to quiet the nervous symptoms and of such drugs as heroine or codeine to allay the cough. The skin, kidneys and bowels should be kept properly active by means of the usual measures.

2. Acute General Tuberculosis of Pulmonary Form.

Symptoms. This type of the disease occurs in adults who have been the subjects of chronic bronchitis or of chronic tuberculosis and is often observed in children after measles or whooping cough. The symptoms are those of a marked acute bronchitis; with the cough there is muco-purulent expectoration; hæmoptysis is rare. Dyspnœa and cyanosis are pronounced; the pulse is rapid and feeble, the temperature irregular, rising at night to 102° to 103° F. (38.9° to 39.4° C.) or, perhaps, elevated in the morning and low in the evening. The spleen is increased in size in infections of acute course. The outcome is invariably fatal, death occurring at times within two weeks. In other instances the disease may progress for several months.

The physical signs are those of bronchitis (sibilant and sonorous râles), or there may be areas of diminished resonance with bronchial or broncho-vesicular breathing and fine crepitant râles due to scattered foci of broncho-pneumonia. Areas over which the note is hyper-resonant, as a result of localized emphysema, may be evident. As the disease progresses the râles become louder and more moist. Tuberculous involvement of the pleura gives rise to friction râles.

The diagnosis is to be made upon the points already set down on p. 159. The presence of marked dyspnœa and cyanosis with the signs of bronchitis is always suspicious. The choroid should be inspected for the presence of tubercles and the sputum examined for the bacilli, which are by no means

always present. A history of lymphoid enlargement or of measles or pertussis will often aid in the diagnosis.

Treatment is likely to prove useless but the patient should be made as comfortable as possible and the symptoms should be relieved as they arise; otherwise the treatment is identical with that of chronic pulmonary tuberculosis.

3. Acute General Tuberculosis of Meningeal Form. See Tuberculous Meningitis, p. 729.

Pulmonary Tuberculosis.

Acute Pneumonic Pulmonary Tuberculosis.

Synonyms. Phthisis Florida; Galloping Consumption.

This type of pulmonary tuberculosis occurs in two forms, the pneumonic and the broncho-pneumonic. In the former one lobe or an entire lung may be affected and its condition resembles that found in acute lobar pneumonia. The pleura is the seat of an exudative inflammation and is filled with cheesy matter composed of aggregations of tubercles, which if the disease lasts long enough, soften, and cavity formation, especially at the apices, takes place. In the broncho-pneumonic type the consolidation takes place in scattered areas, as a result of which there are disseminated foci of whitish cheesy matter which are separated from one another by congested pulmonary tissue. These foci tend to soften and become tiny abscesses. The bronchial lymph glands are usually the seat of tuberculous inflammation.

Symptoms. *The pneumonic type* is more common in adults. Its onset is marked by a chill followed by rise in temperature, cough with mucoid, often blood stained, sputum, pain in the side and dyspnœa. The affection is often mistaken for an acute lobar pneumonia which it resembles markedly in its early symptoms and physical signs, which are those of pulmonary consolidation occurring in one or more lobes. Resolution, however, does not take place but, as the consolidation softens, the physical signs of a cavity become manifest and microscopic examination of the sputum reveals tubercle bacilli. The course of this type of the disease is usually from one to three months, when death may take place or the process may become a chronic pulmonary tuberculosis. A rapid course is rare.

The broncho-pneumonic type is most often met in children in whom it is prone to follow measles or pertussis. The child is affected with a chronic bronchitis with fever, cough and dyspnœa; the signs are those of bronchitis, moist and subcrepitant râles being abundant and small areas of consolidation, evidenced by a high pitched percussion note, broncho-vesicular voice and breathing may be demonstrated. Emaciation is rapid, the temperature be-

comes of hectic type and, as the areas of consolidation soften, tubercle bacilli appear in the sputum. The prognosis is bad, death usually ensuing within one to two months; more rare are the patients in whom the disease is rapidly fatal and those who go on to chronic pulmonary tuberculosis.

Treatment during the acute stage consists in maintaining the patient's nutrition and combating the symptoms as they arise. That of the chronic stage will be considered later under the treatment of chronic pulmonary tuberculosis.

Chronic Pulmonary Tuberculosis.

1. *Chronic Ulcerative Phthisis.*

This is the most common form of pulmonary tuberculosis and begins with the formation of miliary tubercles in various parts of the lung, usually, however, in the apices. At its inception it is a purely tuberculous disease and so remains until the softening and breaking down of the tubercles, when the resulting ulcerating surfaces become infected with the bacteria of suppuration and a so-called "mixed infection" results.

Pathology. The morbid changes present in the lung of chronic ulcerative phthisis are many and varied. The disease spreads from the initial point of infection which is usually a little below the apex of one or the other lung and often nearer the posterior than the anterior aspect. Consequently the situation at which physical signs are first perceptible is either on the anterior surface of the chest just below the middle of the clavicle or posteriorly in the supra-spinous fossa. From this spot the process spreads downward, affecting the outer portion of the upper lobe rather than the inner. Later the apex of the other lung becomes involved but usually not before the disease has affected the upper part of the lower lobe of the lung first attacked. Primary involvement of the bases of the lungs is rare.

The lesions found in the tuberculous lung are by no means constant nor do all the conditions to be described necessarily obtain in every patient. The morbid changes which may occur are as follows:

a. Miliary tubercles. These vary in situation depending upon whether the infection was the result of inhalation or of dissemination of the bacilli by the lymph circulation. In the former instance they are found in the walls of the smaller bronchi or air spaces, in the latter they occur about the primary foci of the inflammation. They also may be seen in the walls of the small blood-vessels.

b. Tuberculous broncho-pneumonia. Here we find areas of caseation due to the accumulation in and around the small bronchi of inflammatory products. These foci tend to coalesce and, if rapid degeneration and softening takes place, break down and result in the formation of small cavities. If the process is more chronic, fibrous tissue may develop about the cheesy mass

finally encapsulating it. The substance within this fibrous capsule may either remain soft and caseous, with areas of calcareous degeneration, or become entirely sclerotic.

c. Tuberculous pneumonia. This is a condition characterized by an exudative inflammation involving the tissues surrounding the tubercles. The adjacent alveoli are filled with epithelioid cells. Such areas of consolidation on cut section resemble the red hepatization of lobar pneumonia or yellowish or whitish spots may be observed due to the presence of foci of fatty degeneration.

d. Cavities, the result of the breaking down of the tuberculous areas, are a characteristic anatomical feature. The wall of the bronchus is vitiated by the tuberculous inflammation and ulceration, is strained by the effort of coughing, yields, and finally gives way forming a cavity at first small but later of larger size, since adjacent cavities tend to unite until an entire lobe may be involved in the process. Fresh cavities possess caseous and necrotic walls, while those of long standing are lined with smooth walls of granulation tissue which produce pus. Into such cavities blood-vessels of considerable size may protrude which may either be the seat of an obliterating endarteritis or of aneurysmal dilatations. Such vessels, if not entirely occluded by the arteritis, when eroded by the inflammatory process, cause hæmorrhage. The cavity contains the pus produced by its lining, tubercle bacilli and other micro-organisms. The lung about the cavity may be consolidated. Small cavities often have ragged and necrotic walls which continually are breaking down. Cavities may also result from the softening at the center of a caseous mass or be bronchiectatic in character. Rupture of a cavity into the pleura with consequent pneumo- or pyo-pneumo-thorax, may take place.

e. Pleurisy accompanies chronic phthisis in the great majority of instances; it may be either simple or tuberculous, in which case miliary tubercles or cheesy deposits are present. There may be thickening of the pleura with adhesions, serous, hæmorrhagic or purulent exudations, or a condition of pyo-pneumo-thorax.

f. The bronchial lymph nodes usually participate in the infection. In the infections of rapid onset and course they are enlarged and softened and contain cheesy areas and miliary tubercles; in instances of more protracted evolution caseous foci, calcareous degeneration or suppuration may be observed.

g. Lesions of other organs. The larynx is frequently involved even to the extent of destruction of the epiglottis and vocal cords. The cervical and retro-peritonæal glands may be seat of tuberculous inflammation and miliary tubercles may be found in the intestine, the spleen, the kidneys, the brain, the liver and the pericardium. Tuberculous endocarditis may be observed. Especially in the protracted infections we may find amyloid and fatty degen-

erations of the viscera. The former occurs in the liver, kidneys, spleen and intestinal lining while the latter is more prone to affect the liver and kidneys.

Symptoms. The invasion of this disease is most insidious and consequently is frequently overlooked. The various modes of onset may be classified as follows:

a. With successive attacks of bronchitis, each more obstinate than its predecessor. The patient takes cold easily and finally is attacked by a bronchitis that refuses to respond to treatment. The cough becomes frequent and distressing and examination reveals the presence of physical signs.

b. With symptoms referable to the stomach. This is by no means a rare mode of invasion but is often overlooked and the patient is sent to the gastrologist who exerts himself in the direction of his specialty while the patient loses much valuable time. Such patients complain of no symptoms pointing toward the lung but suffer from gastric irritability, eructations, vomiting and perhaps hyperacidity. An accompanying anæmia, with palpitation, loss of strength, evening rise of temperature and irregular menstruation, is very frequent in young women. Too much stress cannot be laid upon the great importance of a thorough physical examination of the lungs in patients presenting such symptoms.

c. The onset may take place without exciting the suspicion of the patient to the fact that he is ill, or the pulmonary symptoms may be masked by manifestations due to affections of other tissues, such as the peritonæum, intestinal tract or the bones. The lungs of such patients, very much to their surprise, may be found to be the seat of advanced tuberculous disease.

d. An onset with regularly recurring chills, fever and sweating may occur in which the manifestations strongly suggest malarial infection.

e. Pleurisy, either fibrinous or with the exudation of serum, may mark the invasion of the tuberculous process, signs of the latter appearing after the former conditions have been present for longer or shorter intervals.

Certain German observers have considered all instances of serous pleurisy to be of tuberculous origin but this is quite too sweeping an hypothesis. Those from which blood-tinged fluid is drawn are frequently the result of infection with the bacillus of Koch. Bowditch has reported 90 instances of serous pleurisy which eventuated in pulmonary phthisis.

f. Hæmorrhage from the lungs appears as an initial symptom in a certain number of patients but, in these, careful questioning may elicit a history of chronic cough or hereditary tuberculous predisposition showing that pulmonary involvement has pre-existed.

g. Laryngeal symptoms, especially hoarseness, as initial manifestations would seem to argue tuberculous infection of the larynx as a primary lesion to which those of the lungs are secondary.

h. Pulmonary tuberculosis may be preceded by enlargement of the glands

of the neck or axilla and examination often will reveal involvement of the lung of the same side.

Of the symptoms of chronic phthisis cough is one of the most generally present. At first it is slight, and while it may remain so, as the disease progresses, it usually increases in severity. It is the result of the irritation caused by the bronchitic or pneumonic process or is due to the accumulation of matter in the tuberculous cavities. These when filled are often cleared by successive fits of coughing. Under such conditions paroxysms of coughing occur at intervals. The expectoration varies with the extent of the pulmonary involvement. At first it is scanty and mucoid, and does not contain the bacilli; this is during the so-called pre-bacillary stage, the latter being a misnomer since the bacilli are present within the pulmonary tissues although they do not occur in the bronchial exudate. After ulceration or the rupture of the tuberculous nodules, bacilli are present and, as mixed infection usually takes place at this time, the sputum also contains pus. Blood also may now be present owing to the involvement of blood-vessels by the process of ulceration or the breaking down of the tubercles. In quantity the sputum varies from ½ an ounce (15.0) to eight ounces (250.0) during 24 hours. It is seldom fœtid, usually possessing a faint sweetish odor. The expectorations often take a circular form which is termed nummular from supposed resemblance to a coin. Hæmoptysis occurs in from 60 to 80 percent. of patients and is a result of the rupture of vessels whose walls have become weakened by the tuberculous infiltration or of the erosion of vessel walls by the inflammatory process. Early in the disease the quantity of blood is small but in the later stages it may be so large as to result in death. Another danger of hæmoptysis is that bits of clot may be drawn deeper into the lungs by respiration, and, acting as irritants, cause inhalation pneumonia. Small hæmoptyses early in the disease may occur as a result of the inflammation of the bronchial mucous membrane.

Microscopically the sputum of phthisis may contain mucous, epithelial cells from the respiratory tract or mouth, bits of food, Charcot-Leyden crystals, red blood-cells and, after the lung tissue has begun to break down and mixed infection has taken place, pus cells, tubercle bacilli and elastic tissue. For the technique of the chemical and microscopical examination of sputum the reader is referred to any reliable work upon clinical diagnosis.

The cough, especially late in the disease, often incites emesis, probably due to the irritation of the pharynx caused in the act of coughing.

Pain is not a typical symptom of the disease but may be caused by excessive coughing, in which case it is usually in the lower part of the chest, or by the pleurisy; here it is sharp and stabbing in character and located at the site of the pleural inflammation, although at times it may be referred to the other side of the thorax.

Fever is a very constant symptom. Early in the infection it is the result of the tuberculous process within the lungs and is usually slight and of continued type with, perhaps, slight evening exacerbations. With the breaking down of the tuberculous tissue in the lungs and the incidence of mixed infection, to which latter it is due, the so-called hectic temperature occurs. This is septic both in origin and character, usually reaching its highest point during the afternoon or evening and its minimum during early morning hours. Certain patients may exhibit no distinct febrile movement during their entire course, although these probably have had fever at the onset of the infection. When a continuously high temperature, lasting from a day to a week, is observed, it is usually due to the establishment of a fresh focus of broncho-pneumonia.

With the hectic temperature there are usually sweats. These are the result of septic infection and as a rule occur at night—hence the term "night sweats" —although they may appear at any time.

The pulse is accelerated even early in the disease and this increase in its rate is often an important point in the diagnosis of incipient tuberculosis.

The respirations are not markedly increased in number even with considerable pulmonary involvement. Dyspnœa may occur when there is pneumonic involvement, when there is serous pleurisy or pneumo-thorax and in old infections with emphysema or with pleural thickening and retraction of the thorax.

Emaciation is progressive and is a pronounced and constant symptom. It is a dependable index of the evolution of the disease.

Late in the disease manifestations due to involvement of other organs often occur. Tuberculosis of the intestine is evidenced by obstinate diarrhœa. Meningeal infection causes headache and other cerebral symptoms (see p. 730). Amyloid and fatty degeneration of the viscera result in enlargement of the organs affected and, in the case of the kidneys, albuminuria. Tuberculosis of the genito-urinary tract with pus and tubercle bacilli in the urine may occur.

Physical Signs. These vary with the stage of the disease. Careful physical examination of the chest is very important in all suspected instances and the early physical signs, i.e., those present in the incipient or pre-bacillary stage, while typical and easily detected by the acute observer, may be overlooked. These are: *a.* Myoidema of the chest muscles. This phenomenon, while not characteristic of pulmonary tuberculosis, is significant of a hyperæsthetic condition of the reflexes and is likely to occur as a result of any disease interfering with nutrition. *b.* Upon auscultation of the heart the second pulmonic sound is found to be accentuated owing to the obstruction to the pulmonary circulation caused by the inflammatory process in the lung. *c.* The cardiac sounds are heard at the apex of the lung as a result of trans-

mission through the infiltrated pulmonary tissue. *d.* The whispering voice at the apex or just below the clavicle is bronchial in character. *e.* A blowing murmur in the subclavian or the pulmonary artery may be present. Upon these signs the diagnosis can be made even before distinct dulness upon percussion or the presence of râles can be detected.

In the more advanced *first stage* of the disease the signs are:

a. Inspection. The shape of the chest, while not characteristic, is often long and narrow with wide intercostal spaces and ribs tending toward the vertical in direction. The scapulæ are of the "winged" type. The thorax in other instances may be flattened antero-posteriorly and the costal cartilages are prominent. Depression above the clavicle and retraction below are important signs, the clavicle being more prominent than normal. The body may be more or less wasted, the respiration may be slightly accelerated and the pulse rate increased. A cardiac apex pulsating over an increased area is suggestive of involvement at the left apex. On deep inspiration one side of the thorax will often expand less than the other; especially is this diminution of expansion noticeable above and just below the clavicle.

b. Mensuration often reveals not only a diminished expansion of the affected side but the fact that this half of the chest is of less circumference than the other while at rest.

c. Palpation may detect the presence of increased fremitus over the affected apex, but the normal exaggeration of the fremitus of the right over that of the left apex should not be forgotten.

d. Percussion. At this stage the note above or just below the clavicle is usually duller than normal.

e. Auscultation reveals an increase in the length of the expiratory murmur and a diminution in the intensity of the inspiratory sound, or the latter has become harsh or broncho-vesicular. The vocal resonance is increased, the whispered bronchophony referred to above is present and the physical signs of a more or less generalized bronchitis are usually obtainable. Crepitant and subcrepitant râles at the apices are a frequent and characteristic sign. They are due to pleuritic adhesions, in which case they are close under the ear, occur with both inspiration and expiration and are increased upon pressure by the stethoscope, or to bronchitis; here they are more distinct, are heard at the end of inspiration and are not increased on pressure. Coughing may render them audible when they cannot be detected upon respiration.

In the *second stage* inspection reveals an exaggeration of the changes already described, the emaciation is more pronounced, the hectic flush may be present and the surface temperature may be heightened. The exaggerated vocal fremitus may be easily detected unless a thickened pleura prevents its recognition. The percussion note is now distinctly dull.

Auscultation reveals an increased and perhaps a broncho-vesicular quality

of the spoken voice, the breathing has become more bronchial in character and the expiration is further prolonged and is blowing in quality. Ultimately the breathing and voice, as the consolidation becomes more pronounced and of greater extent, become bronchial. Râles due to pleuritic and bronchial inflammation are also present.

The signs revealed during the *third stage* by inspection are those of the second in a more advanced condition; the wasting is still more apparent, the retraction of the chest is more marked, the respiratory movement more restricted. The surface temperature is perceptibly increased, the skin may be moist if sweating is present and the vocal fremitus is further exaggerated. The dulness on percussion is often increased to flatness and, upon the occurrence of cavity formation, becomes tympanitic, amphoric or "cracked pot" in character, if the lesion is near the surface. The note may be unchanged if the cavity is small and deeply-seated. Wintrich's sign is pathognomonic; given a cavity communicating with a bronchus the note elicited by percussion is lower in pitch with the mouth shut than with open mouth.

Auscultation reveals the presence of moist râles resulting from the softening and breaking down of the tuberculous deposits. Over cavities the breathing is cavernous or amphoric and the voice possesses similar quantities; pectoriloquy upon whispering or speaking aloud may be present. The amphoric quality is given to the breathing if the cavity walls are firm and smooth, while with softer walls a cavernous quality is transmitted to the voice. Gurgling râles may be caused by the air passing through the fluid contents of a cavity.

The diagnosis of chronic phthisis presents difficulties during the early stages only; unfortunately the presence of the bacillus in the sputum is not likely to occur until there is ulceration or disintegration of the tuberculous nodules. It is most important that the diagnosis should be made as early in the disease as possible for at this time treatment, properly applied, is able, in most instances to effect a cure. The early physical signs upon which stress should be laid are the presence of slight dulness and diminished breathing and prolonged expiration at the apices, together with whispering bronchophony, a transmission of the heart sounds toward the apices and an accentuation of the second pulmonic sound. These last three signs are obtainable two to three months before the X-ray will give a shadow. An increased rapidity of the pulse, slight evening rises of temperature, coupled with a flushed cheek, a dilated pupil and perhaps loss of flesh, are always suspicious. Streaks of blood in the expectoration, though these may come from the naso-pharynx, should always lead the physician to make a most careful physical examination. It may be stated that the patient in whom a pulmonary hæmorrhage is an early symptom is fortunate since it induces him to consult the medical man and to watch his condition most carefully.

The tuberculin test may be employed in dubious instances; it is without

danger and is usually reliable. Its technique is as follows: A hypodermatic injection of $\frac{1}{60}$ of a grain (0.001) of pure tuberculin is given. Should no febrile reaction ensue within 10 or 12 hours the dose is doubled 2 or 3 days later and is progressively increased until $\frac{1}{12}$ of a grain (0.005) is given. If no rise of temperature is evident after this dosage tuberculosis is probably absent. The agglutination and serum tests advocated by Arloing and Courmont may prove to be very useful. Early in the disease the Röntgen ray has only a limited use in the diagnosis since the only noticeable abnormality is a diminished excursion of the diaphragm upon the affected side. Areas of consolidation are indicated by distinct shadows and special infiltrations may be evidenced by a blurred appearance upon the plate.

Fibroid Phthisis.

In this disease, associated with the tuberculous process, there is a productive inflammation of the lung resulting in an increased growth of fibroid tissue. The condition is gradual in onset and it may occur following chronic ulcerative phthisis or it may be engrafted upon a tuberculous bronchopneumonia or pleurisy. The lung is firm, tough and grayish on section as a result of the over-growth of fibrous tissue; the bronchi may be dilated and bronchiectatic cavities are often present; tuberculous cavities are observed at the apices; cheesy foci surrounded by fibrous tissue may be present; in the two last lesions tubercle bacilli are to be found. While one lung is in the condition described the other may be emphysematous or contain miliary tubercles. The right heart, and sometimes the left as well, is hypertrophied and there may be amyloid degeneration of the viscera.

Symptoms. Cough is present and is frequently paroxysmal, but this, with the other symptoms, emaciation, fever, etc., is less pronounced than in ulcerative phthisis. The sputum is often profuse, owing to the presence of bronchiectatic and other cavities, and may be fœtid. Bacilli are less easily found than in ordinary chronic phthisis. Pulmonary hæmorrhage may occur and œdema of the feet may result from failure of the heart's action. The course of the disease is usually protracted.

Physical Signs. The chest wall over the diseased lung is sunken and the heart may be displaced owing to retraction of the lung. The intercostal spaces are narrow and the area of the cardiac apex beat may be much enlarged. The characteristic percussion note is dull and high-pitched; vocal fremitus is diminished. Auscultation may reveal the presence of cavities, especially at the apices, elsewhere there are areas of bronchial breathing and increased vocal resonance, unless the pleura is thickened. Bronchiectatic cavities may be present in the middle or lower lobes. The signs of emphysema may be noted in the other lung and cardiac murmurs are not infrequent.

The Prognosis of Chronic Pulmonary Tuberculosis.

In the ulcerative as well as in the fibroid form of the disease, although the duration of the latter type is longer, the prognosis is serious, but it is certain that many subjects of pulmonary infection with tuberculosis do spontaneously recover. This is proven by the numberless autopsies, in deaths from other causes, in which healed tuberculous lesions are found. In these the tubercles have undergone fibroid or calcareous degeneration. In the encapsulated caseous masses while the process may be considered inactive it cannot be said to have wholly ceased to exist. Even patients, in whose sputum bacilli and elastic tissue have been demonstrated, have recovered; consequently in the light of the above stated facts we may safely say that pulmonary tuberculosis is a curable disease.

The patients in whom the prognosis is most favorable are those with good heredity, previous robust health and good digestion, slow invasion, only slight febrile movement and slight pulmonary involvement. When the initial inflammation is pleuritic, recovery may be considered probable, while the opposite is true of sujects with frequent pulmonary hæmorrhages.

The average duration of the disease differs, being, according to the statistics of different observers, from two and a half to seven years. Proper treatment will, in the great majority of instances, render the patient more comfortable and materially prolong his life.

Prophylaxis. This consideration is quite as important as treatment, for in the light of our present knowledge the disease is distinctly preventable in most instances.

The public should be educated by such means as those employed by the Department of Health of New York City, and pulmonary tuberculosis should be considered a reportable disease on account of its infectious character. The following is a copy of a circular issued and circulated by the New York Health Department indicating the attempt that is being made to awaken the masses to the importance of the crusade against tuberculosis.

"Consumption is a disease of the lungs, which is taken from others, and is not simply caused by colds, although a cold may make it easier to take the disease. It is caused by very minute germs, which usually enter the body with the air breathed. The matter which consumptives cough or spit up contains these germs in great numbers—frequently millions are discharged in a single day. This matter, spit upon the floor, wall or elsewhere, dries and is apt to become powdered and float in the air as dust. The dust contains the germs, and thus they enter the body with the air breathed. This dust is especially likely to be dangerous within doors. The breath of a consumptive does not contain the germs and will not produce the disease. A well

person catches the disease from a consumptive only by in some way taking in the matter coughed up by the consumptive.

"Consumption can often be cured if its nature be recognized early and if proper means be taken for its treatment. *In a majority of instances it is not a fatal disease.*

"It is not dangerous to live with a consumptive, if the matter coughed up by him be promptly destroyed. This matter should not be spit upon the floor, carpet, stove, wall or sidewalk, but always, if possible, in a cup kept for that purpose. The cup should contain water so that the matter will not dry, or better, carbolic acid in a five percent. watery solution (six teaspoonfuls in a pint of water). This solution kills the germs. The cup should be emptied into the water closet at least twice a day, and carefully washed with boiling water.

"Great care should be taken by consumptives to prevent their hands, faces and clothing from becoming soiled with the matter coughed up. If they do become thus soiled, they should be at once washed with soap and hot water. Men with consumption should wear no beards at all, or only closely cut mustaches. When consumptives are away from home, the matter coughed up should be received in a pocket flask made for this purpose. If cloths must be used, they should be immediately burned on returning home. If handkerchiefs be used (worthless cloths, which can be at once burned, are far better), they should be boiled at least half an hour in water by themselves before being washed. When coughing or sneezing, small particles of spittle containing germs are expelled, so that consumptives should always hold a handkerchief or cloth before the mouth during these acts; otherwise, the use of cloths and handkerchiefs to receive the matter coughed up should be avoided as much as possible, because it readily dries on these, and becomes separated and scattered into the air. Hence, *when possible, the matter should be received into cups or flasks.* Paper cups are better than ordinary cups, as the former with their contents may be burned after being used. A pocket flask of glass, metal, or pasteboard is also a most convenient receptacle to spit in when away from home. Cheap and convenient forms of flasks and cups may be purchased at many drug stores. Patients too weak to use a cup should use moist rags, which should at once be burned. If cloths are used they should not be carried loose in the pocket, but in a waterproof receptacle (tobacco pouch), which should be frequently boiled. A consumptive should never swallow his expectoration.

"A consumptive should have his own bed, and, if possible, his own room. The room should always have an abundance of fresh air—the window should be open day and night. The patient's soiled wash-clothes and bed linen should be handled as little as possible when dry, but should be placed in water until ready for washing.

"If the matter coughed up be rendered harmless, a consumptive may frequently not only do his usual work without giving the disease to others, but may also thus improve his own condition and increase his chances of getting well.

"Whenever a person is thought to be suffering from consumption, the Department of Health should be notified and a medical inspector will call and examine the person to see if he has consumption, providing he has no physician, and then, if necessary, will give proper directions as to treatment.

"Rooms which have been occupied by consumptives should be thoroughly cleaned, scrubbed, whitewashed, painted or papered before they are again occupied. Carpets, rugs, bedding, etc., from rooms which have been occupied by consumptives, should be disinfected. Such articles, if the Department of Health be notified, will be sent for, disinfected and returned to the owner free of charge, or, if he so desire, they will be destroyed.

"*When consumptives move they should notify the Department of Health.*

"*Consumptives are warned against the many widely advertised cures, specific and special methods of treatment of consumption. No cure can be expected from any kind of medicine or method, except the regularly accepted treatment, which depends upon pure air, an out-of-door life and nourishing food.*"

Legislation with reference to the sanitary condition of tenement houses, to the inspection of the sources of our meat and milk supply and against promiscuous expectoration is a necessary step in prevention, as well as thorough disinfection of rooms and their contents, after occupation by tuberculous individuals, and the establishment of municipal, state or even federal sanatoriums and tuberculosis dispensaries. At least one of the hospitals of New York City has a corps of visiting nurses who go to the houses of patients who are under treatment at the institution's out-patient department and instruct the family in the necessity of cleanliness, in the care of sputum, etc.

The sputum, being the chief means by which the disease is disseminated, should be thoroughly and at once destroyed. It should be received into earthen or enamel-ware cups in which a 1 to 1,000 solution of mercury bichloride or a 4 percent. solution of phenol is constantly kept; where it is impossible to procure these germicides water should be substituted since the bacilli unless dried are not carried by the air, or the patient may expectorate into bits of old muslin or even a Japanese napkin which is to be immediately burned. The burnable pasteboard sputum cup is a useful and safe appliance. All permanent receptacles for sputum should be scalded out with boiling water at least once a day.

The proper care of delicate children, whether born of tuberculous parents or not, is most important. The tuberculous mother should not nurse her child and the general surroundings of the predisposed infant should be of the most healthful character. Catarrhal diseases are much to be feared, consequently the child should not be allowed out of doors upon cloudy, damp

days during the cold months and the condition of the upper air passages should be kept as healthful as possible. The importance of the removal of adenoids and hypertrophied tonsils cannot be over-estimated. Proper clothing—woolen next the skin—should be worn. After the child's bath, sponging with cold water—60° to 70° F. (15.5° to 21° C.)—is an excellent method of hardening. The diet should be plentiful, plain and nourishing and a liking for milk, if not already present, should be cultivated. All illnesses, no matter how insignificant should be carefully treated and the administration of such tonics as iron, especially syrupus ferri iodidi, arsenic and codliver oil, may be attended with benefit. As the child grows older he should be encouraged to lead an out-door life, exposure to cold and wet, however, being avoided, and in the pursuance of gymnastic and respiratory exercises. When it becomes necessary to choose his life-occupation one which will tend to keep the subject in the open air as much as possible is to be preferred.

Protection by Immunization. Von Behring claims to have discovered a method of immunization of man which is sure, rapid and without danger. He believes that the immunizing substance is contained in the bodies of the tubercle bacilli and acts by combining with certain living cellular elements. His theories have been proven by animal experimentation and he believes that it is possible by the same methods to protect the human subject against tuberculous infection. The discovery is not to be given to the world until further experimentation and clinical study have been carried out. A statement like the above coming from Professor von Behring carries much weight.

Treatment. Pulmonary phthisis is an infection and should be treated as such. The patient's life should be regulated and his condition watched as carefully as in enteric fever or diphtheria. Each patient is a law into himself, consequently no one method is applicable in all instances and seldom does any single method succeed in a given subject, the best results being obtained by a combination of appropriate modes of treatment. Climatic treatment, dietetic treatment, drug treatment, each has a distinct place but we should not be satisfied to employ them singly; we should use all means at our disposal, keep up the patient's nutrition, constantly watch him in every phase of his disease and work continuously to benefit him. The special considerations are to improve the nutrition by proper hygienic mode of life and feeding; to arrest the tuberculous process; and to relieve the unpleasant symptoms as they arise.

a. Climatic Treatment. When it is possible to remove the patient, a suitable climate should be sought as soon as the diagnosis is suspected. The ideal climate is dry, of equable temperature and one which affords the largest number of sunny days; such a one is, however, impossible to find since no dry climate possesses an equable temperature, consequently we should select a region the meteorological characteristics of which approach as nearly as

possible to this ideal. In many instances it will be impossible to choose a climate for a given patient and the only possible method of selection is to experiment until one is found in which the subject does well. In general it may be stated that an altitude of from 2,000 to 2,500 feet is more favorable than a low lying region. Another important consideration is that the patient must not be sent to a place where good accommodations and food cannot be obtained.

Evans gives the following useful classification of climates.

1. Cool moderately moist climate, general elevation 2,000 feet—the western slope of the Appalachian range, the Adirondacks, Catskills, Alleghanies, and Cumberland mountains.

2. Moderately warm and moist climate, elevation 2,250 feet—Asheville, N. C.; Aiken, S. C.; Marietta and Thomasville, Ga.

3. Warm and moist climate—the coast regions of Florida and Southern California.

4. Warm and moderately dry climate, elevation about 2,000 feet—Southwestern Texas and Southern California inland.

5. Cool and moderately dry climate, elevation about 1,000 feet—Minnesota, Nebraska and Dakota.

6. Cool and dry climate, elevation 4,000 to 7,000 feet—Montana, Wyoming, Colorado, Northern New Mexico and Western Kansas; Davos and St. Moritz, Europe.

7. Warm and dry climate, elevation 3,000 to 5,000 feet—Southern New Mexico and Southern Arizona.

The Adirondacks are a very favorite resort for the tuberculous of the vicinity of New York City and, even though the elevation is considerable, the permanence of an established cure is not jeopardized by a return to sea-level. The patients who do best at an altitude are those in whom the disease has not of advanced infections, especially if emphysema or cardiac weakness is present. gone on to cavity formation and whose nutrition is good; the opposite is true Such conditions usually contra-indicate removal to a high altitude and the patient is more likely to be benefited by a moist and warm climate than by one which is cold and dry. In conclusion it may be stated that life in the open air is essential in whatever climate the patient may be.

Hygienic treatment consists in first securing ventilation and sunlight. The dwelling should be situated upon high rather than low ground and should be as accessible to the sun as possible. The importance of the latter consideration is shown by the fact that instance after instance of tuberculosis continued to occur in certain houses in Massachusetts until the removal of the many trees about them. After this was done the disease disappeared as if by magic. Proper drainage is important and the patient's apartment should be one to which the sunlight has access for as much of the day as possible.

Ventilation by a fireplace is to be advised and the patient should sleep with the windows open even in the coldest weather, but protection from draughts must be secured. The air within the sleeping-room should be identical with that out of doors.

During the day the patient should spend as much of the time in the open air as possible and should take such exercise in moderation as the condition of his circulatory apparatus will allow. Sitting in the sunlight should be encouraged but it is better to keep in motion if the physical condition permits.

The employment of hydrotherapeutic treatment as a curative measure may be neglected; it is, however, important in prophylaxis. Daily baths should be taken in order to keep the skin and circulation active. Cool water may be used but not unless the rub down after the bath is succeeded by a good reaction. The risk of chilling the body should not be taken.

Breathing exercises are important and by their means the lung capacity and chest expansion are capable of a considerable increase. They consist in taking several successive deep breaths, the patient standing upright in the open air meanwhile. Each breath is held for a few seconds and then slowly exhaled. In proper instances, the condition of the heart permitting, calisthenics in moderation are excellent. The exercises which comprise the "setting up drill" of the United States Army may be employed.

The patient's clothing is an important consideration, wool, of weight varied according to the temperature, should be worn next the skin at all seasons of the year, both day and night. As a sleeping dress nothing is better than pajamas of flannel or a night-gown reaching to the feet.

The open-air treatment has been much exploited of late and is undoubtedly a method of great value. It may be employed at home in the city or country or in institutions. It may be difficult to carry out in the city but if the physician insists upon its importance it will be possible to overcome many obstacles. The roof or back yard may be used upon pleasant days, and an ordinary steamer chair provided with cushions and blankets makes an excellent couch if it is necessary that the patient recline. Days upon which it is not advisable to send the patient actually out of doors he should recline, warmly wrapped, if necessary, before the open window of his apartment which should be the most sunny and airy room in the house. At night the windows should be open so that, unless the weather absolutely forbids, the patient spends practically all his time in the open air. Such symptoms as fever, sweats and hæmoptysis should not be allowed to interfere with the treatment.

The sanatorium treatment has recently been developed to a considerable degree. The great advantage of institutional treatment is that the patient's mode of life is in every way regulated upon the lines most beneficial to him. Exercise, sleep, diet, amusement, etc., are arranged in accordance with the most hygienic methods. Emphasis must be laid upon the importance of

the establishment of public sanatoriums near large cities so as to be available for early infections and patients of moderate mean.

Tent life for the tuberculous. This mode of treatment is only another phase of the out-door fresh air method. Tents or tent cottages may be constructed according to any desirable plan and life in these is practically an existence in the open air.

Dietetic treatment is perhaps the most important consideration in the management of pulmonary tuberculosis but presents certain difficulties. The importance of proper feeding cannot be too strongly emphasized; the well-nourished organism is able to throw off tuberculous infection and it is certainly probable that the poorly nourished organism which is the subject of a tuberculous infection can better combat this prejudicial condition if its nutrition is improved in every possible way. Many patients will state that they cannot eat, yet if they are encouraged to try, they will, before the meal is finished, give evidence of a very respectable appetite.

Any system of feeding which departs markedly from the proper proportion of proteids, fats and carbohydrates is not a wise one, as is shown by the failure of the raw-beef and hot-water treatment; this fails in a large proportion of patients because the amount of albuminous material is so great that it over-taxes elimination. The Debove method of treatment by over-feeding (see p. 629) may be followed by considerable gains of flesh but unfortunately, while the increase in weight is going on, the tuberculous process remains stationary, and the method has the additional disadvantage that very careful watching of the patient is required to prevent the disagreeable consequences of over-feeding. This mode of feeding is best reserved for patients with tuberculous laryngitis where it has one distinct advantage that is of great value in certain instances. It is a curious fact that these patients, who are often prone to vomit, a very distressing symptom in tuberculosis of the larynx, seldom do so when food is introduced by the stomach tube.

The proper diet for patients suffering from pulmonary tuberculosis should consist of meats, starches and fats, with an excess of the last, and a certain amount of phosphates. Light and nutritious food should be given, it should be easily digestible and the meals should be frequent. They should be separated into those containing the bulk of the starchy food and those consisting chiefly of proteids. Three to three and a half hours should be allowed for the digestion of the heavier meals so that the stomach shall be fairly emptied before it receives the next consignment of food.

The first meal should be at about 7 A. M. when the patient takes a glass of warm (not hot) milk containing a tablespoonful of strong coffee made according to the French method, or, if the previous night has been an exhausting one, a dessertspoonful of rum or other spirit which has previously been mixed with enough water to reduce its alcohol content to not more than 5

percent., otherwise the spirit will coagulate the albumin of the milk and render it less digestible. Breakfast is taken at 9 A. M. The patient is allowed eggs cooked in any way except by frying, although if frying is an essential it may be done in the Italian method, i.e., in olive oil. Prepared thus eggs are much less indigestible than when fried in lard. Bread is also permitted and marmalade if the patient likes. Finnan haddie pleases certain patients, when it is cured by smoking and without salt, and it seems to agree with them although it is a theoretically incorrect article of diet. Toasted bread or good rolls (not hot) are allowable and bread and butter, milk and coffee may be used for variety.

About eleven o'clock the patient has the second breakfast, which usually consists of a little cocoa from which the fat has been taken out. Cocoa butter is one of the most indigestible fats, therefore it should be removed, or or else predigested. The patient may also have coffee, a little bread, a little soup or a little beef extract. An eggnog is permissible, and kumyss or matzoon is often acceptable.

The dinner should be served about one o'clock in the afternoon, and should be *the* meal of the day. The patients may have any kind of meat they relish, except salted meat, but it must not be fried. Potatoes, fresh vegetables, fruits, and puddings may also be allowed. Coffee, tea, or possibly a bottle of light beer, may be added.

About four o'clock in the afternoon they should have a little meat extract with toasted bread, and about five o'clock, a little more should be given. About seven o'clock in the evening comes supper, consisting chiefly of farinaceous food. Many of these patients like what is known as hasty-pudding which is made by putting corn meal into a kettle with water, and stirring it while it is boiling, seasoning to taste. Various jellies, beef extracts, and gruels are useful at this time. If the patient is awake at eleven a cup of milk or hot soup may act as a hypnotic.

Patients who exhibit a hectic temperature are better without alcohol after the 1 P. M. dinner because the alcohol seems to increase the fever. In general alcohol should be taken only in moderate amount and well diluted. After noon only beer is to be permitted, with perhaps, stout upon retiring.

The starchy foods, since upon these we must depend to improve nutrition, should be given with as little liquid as possible and their digestibility should be increased by the addition of a malt extract, which in itself is nutritious and contains diastase. All *liquid* malt extracts are utterly useless for the transformation of starch into dextrin and maltose, because they contain alcohol which inhibits the effect on the starch, and because they contain acids, generated in the process of fermentation, which also inhibit the action of the diastase. The semi-solid extracts of malt convert starch into sugar. This conversion commences to take place in the mouth. For the first thirty or forty minutes

after food has been taken into the stomach, this process goes on. It later stops, but recommences in the duodenum and continues until all the starches are converted into dextrin, and finally into maltose. That this conversion continues in the stomach has been proven conclusively by Kellogg. The great disadvantage of most of the active preparations of malt is their viscosity, which renders them, after a little time, objects of disgust. It is now possible to obtain a preparation of malt, which contains from four to five percent. diastasic converting power. With such a preparation as maltzyme we can be assured that the starches will be digested. The starches are for nourishment, for the generation of heat, and for the formation of fat. This is just what one wants for a tuberculous patient. Further than this recent investigations tend to show that the sugars are important in the generation of force. That is to say: Under a constant diet more than a proportionately larger amount of energy is developed if sugar be added to the dietary.

Life in the open air is a great stimulant to the appetite and an occasional gastric lavage may remove the mucus from a sluggish stomach and increase the desire for food; a dose of one of the vegetable bitters taken before meals now and then is an excellent measure. Of these perhaps the best is condurango, dose of the fluidextract 20 to 30 drops (1.33 to 2.0). Nux vomica and gentian are also to be recommended.

Medicinal Treatment. Creosote has been employed in pulmonary tuberculosis since 1842 and is perhaps the only remedy which has never been abandoned. Its chief disadvantage is that it is often irritant to the stomach and the kidneys but this can be avoided in great measure by the use of creosote carbonate or of pure beechwood creosote. The former is preferable since it may be, on account of its less irritant qualities, administered in much larger dosage. It contains 92 percent. of creosote and may be given in dose of from 15 to 60 minims (1.0 to 4.0) in a wineglass (60.0) of sherry after meals or in milk or bouillon. It may also be given in codliver oil, 1 part to 10. Creosote carbonate is slowly absorbed and is probably eliminated chiefly by the bronchial mucous membrane. It is the drug upon which we place our chief reliance in treating pulmonary tuberculosis.

Creosote itself may be used in various ways but it is very important that it should be pure; it is frequently contaminated with phenol the presence of which may be proven by moistening a match with the suspected fluid; if impure the wood is stained bluish Creosote may be administered in the form of an emulsion with codliver oil and acacia, with codliver oil and the hypophosphites, with syrup of wild cherry and acacia, 2 minims (0.3) of creosote to 1 drachm (4.0) of the emulsion in each case—or in a mixture of glycerin and whiskey. The dose of creosote should be $\frac{1}{2}$ to 2 minims (0.03 to 0.13) given thrice daily and gradually increased to 20 to 25 minims (1 33 to 1.66) in the 24 hours. Given in pills coated with keratin, which will dissolve

only in the intestine, a daily dosage of from 45 to 50 minims (3.0 to 3.3) can be reached without inconvenience. The following prescriptions may be found useful: ℞ creosote ℥i (4.0), tincturæ nucis vomicæ ℥ss (15.0), tincturæ gentianæ compositæ q. s. ad ℥iv (120.0). Misce et signa, one teaspoonful 3 times a day after meals; ℞ creosoti ℥i (4.0), balsami tolutani gr. cv (7.0), terpini hydratis gr. 15 (1.0), acidi benzoici, q. s. Misce et divide in pilulas numero lxxx. Signa. Take 10 pills per day. The hypodermatic administration of creosote in sterile oil requires a special apparatus and is very tedious and painful. Creosote by inhalation is especially indicated when the sputum is fœtid. The sponge of a perforated zinc inhaler is wet with a mixture of equal parts of beechwood creosote, spirit of chloroform and alcohol and the apparatus is used for 15 minutes in every hour.

If the dosage of creosote, when given by mouth, is increased too rapidly, nausea, epigastric distress and even vomiting may result and the urine may become darkened and contain blood and granular casts, but if the increase of dose is slow the patient may acquire a tolerance for the drug; 50 minims (3.33) should be considered a maximum daily dosage. When it is impossible to give creosote by mouth it may be given in enema as follows. This method is preferable to its hypodermatic administration and is specially indicated in tuberculous diarrhœa or enteritis. The enema is made up of ½ to 1 drachm (2.0 to 4.0) of creosote dissolved in 6 drachms (25.0) of oil of sweet almonds. This is emulsified by the addition of the yolk of an egg and the whole is mixed with 6 ounces (200.0) of water. A more easily made enema consists of from 15 to 45 minims (1.0 to 3.0) of creosote mixed with 4 to 8 ounces (125.0 to 250.0) of water. This mixture should be thoroughly agitated before administration and may be given 2 or 3 times daily.

An excellent substitute for creosote is gomenol, an oily liquid analogous to oil of cajuput and distilled from the leaves of *melaleuca viridiflora;* its dosage is from 30 to 60 minims (2.0 to 4.0) in capsules daily. Another substitute is guaiacol—8 minims (0.5)—3 times a day or better, guaiacol carbonate, the dose of which is twice as large.

Codliver oil is a valuable aid in the treatment of tuberculosis. Pure oil is unpleasant to the taste but fortunately children frequently take it with avidity. The objections of older persons may be avoided by giving it in soft capsules or in the official emulsion. Some patients are able to take the oil by previously rinsing the mouth with whiskey or brandy or by putting a little salt in the mouth after swallowing the dose. To render the oil less unpalatable 10 minims (0.66) of pure æther or a drop or two of peppermint or clove oil may be added to each dose. One part of essential oil of eucalyptus is said to entirely do away with odor and taste and a nutritious combination may be made by rubbing together equal parts of codliver oil and malt extract. Another method of disguise is to add to 400 parts of the oil

10 parts of animal charcoal and 20 of ground roasted coffee; the mixture is digested on a water bath at 122° to 140° F. (50° to 60° C.) and after standing for three days is filtered and stored in well-stoppered bottles. Iron may be combined with the oil as follows: ℞ olei morrhuæ ℥iv (15.0), ferri et ammonii citratis gr. v (0.33), potassii carbonatis gr. iii (0.20), saccharini gr. ¼ (0.015), olei cari ♏ ¼ (0.015), aquæ destillatæ q.s. ad ℥i (30.0).

Codliver oil is considered as contraindicated in diarrhœa. hæmoptysis, dyspepsia, vomiting and fever.

The hypophosphites are useful especially in the primary stages when our prime object is to improve the patient's nutrition. It is important that they should be chemically pure and neutral in reaction, for the presence of free alkali or alkaline carbonates quickly causes an atonic dyspepsia. The official syrups of mixed hypophosphites are faulty in that each salt has a peculiar property; the final effect of hypophosphite medication is due to the beneficial effect upon nutrition of the particular salt prescribed. In the early stages of phthisis (infiltration) the sodium salt only should be administered; where cavities are present the calcium salt only is indicated, provided that it does not too suddenly check expectoration, when the sodium salt should be resumed. The potassium salt is a valuable expectorant in chronic bronchitis but its usefulness in phthisis is limited. The hypophosphites, intelligently administered, will improve nutrition and relieve certain of the symptoms of pulmonary tuberculosis, but when given in too large doses, or simultaneously with iron, arsenic, strychnine or other stimulants or codliver oil, they are likely not only to fail but to cause digestive disturbances. Quinine hypophosphite is useful in the last stages of the disease only, and then probably merely as a placebo.

The tonics, especially iron and arsenic, are often useful to combat the secondary anæmia of chronic phthisis. The latter should not be given to alcoholics or to patients who suffer from gastro-intestinal disturbances or hæmoptyses. It is often wise to give the arsenic for 3 days in the week or 15 or 20 days in the month. It may be given in the form of sodium arsenate gr. $\frac{1}{12}$ to ¼ (0.005 to 0.016), or as Fowler's solution, 2 to 8 minims (0.13 to 0.5) 3 times a day. The latter may, if necessary, be administered *per rectum* mixed with water in dosage twice the size of that given by mouth. Sodium cacodylate which contains 50 percent. of arsenic may be given in pill form—each pill to contain ⅙ of a grain (0.011)—from 3 to 6 pills a day and in the anæmia of those predisposed to tuberculosis this drug combined with iron and ammonium citrate is to be recommended.

The Treatment of Special Symptoms. Fever necessitates rest, which of course may be taken in the open air. Quinine and the salicylates are of little use; the former, if given in dose large enough to control the temperature is very prone to disturb the digestion. Small doses of salipyrine, acetpheneti-

dine or antipyrine are often effectual. Temperatures above 103° F. (39.5° C.) may be relieved by sponging with cool water.

The cough, if slight, may be relieved by simple mixtures containing dilute hydrocyanic acid 2 to 3 minims (0.12 to 0.18) to the dose; as vehicles the syrups of tolu or wild cherry may be employed. Syrups, however, when continued, are very apt to disturb the gastric functions. More distressing cough necessitates the administration of heroine $\frac{1}{40}$ to $\frac{1}{20}$ of a grain (0.0016 to 0.0033) or codeine $\frac{1}{4}$ to $\frac{1}{2}$ a grain (0.0165 to 0.0033) every 4 hours. In the advanced stages frequently only morphine will relieve this symptom. Sufficient quantity may be given to control the cough during sleep but not so much as to inhibit the expectoration of the accumulations of the night when the patient awakes. This may be facilitated by administering a glass of hot milk or a milk punch. If the bronchial secretions are tough and not easily raised they may be softened and their expectoration made less difficult by the administration of soluble capsules containing terpene hydrate gr. v (0.33) and heroine gr. $\frac{1}{20}$ (0.0033). Terebene is also useful in this connection although it may disturb the stomach. It may be given in doses of 5 to 10 minims (0.33 to 0.66) 3 times a day well diluted. If the cough, after examination, appears to be due to involvement of the larynx the measures described on p. 628 are applicable.

Hæmoptysis is an important symptom. The patient should be kept absolutely at rest, in the recumbent position, but with the shoulders slightly raised. Cold applications should be made to the chest in the form of the ice coil, the ice bag or cold compresses wrung out in ice water, and the patient may be given bits of ice to suck. The early administration of a hypodermatic injection of morphine sulphate $\frac{1}{4}$ to $\frac{1}{3}$ of a grain (0.016 to 0.022) is usually advisable. All measures which increase the blood pressure should be avoided and if the arterial tension is high aconite may be given in doses of 3 to 5 minims (0.2 to 0.33) of the tincture every hour until the desired effect is produced. A very important measure is the administration of one of the salts of calcium in order to increase the coagulability of the blood. The most effectual of these is the lactate, next in order is the chloride, the former being from 2 to 3 times as potent as the latter. The initial dose of either is 40 grains (1.66) and they afterward may be given in 20 grain (1.33) doses three times a day. The exhibition of the preparations of ergot, gallic and tannic acid and of the lead salts is probably useless. Supra-renal extract in doses of 5 grains (0.33) every 2 or 3 hours and the hypodermatic administration of $3\frac{1}{2}$ ounces (100.0) of a 10 percent. gelatin solution at 110° F. (43° C.) are recommended; the latter, it is said, possesses hæmostatic properties and may be given also by mouth. The ordinary preparation, which may be found in every kitchen, may be taken dissolved in water in doses of 2 ounces (60.0) every 2 or 3 hours. Fortunately pulmonary hæmorrhage in itself is seldom fatal and tends sponta-

neously to become checked. In cases where the quantity of blood lost jeopardizes the life of the patient the limbs should be bandaged from the fingers and toes toward the body; enteroclyses and hypodermatoclyses of hot normal saline solution should be given to supply the loss. The treatment of hæmoptysis by means of inhalation of amyl nitrite has recently been much extolled and is apparently based upon reasonable principles.

Sweating is often a distressing symptom and numerous drugs have been employed in its control. An excellent method of relieving the night sweats which usually make their appearance during the early morning is to wake the patient about 4 A. M. and give him a tumbler of warm milk containing a little whiskey; this procedure has the additional advantage of supplying extra food. Aromatic sulphuric acid—15 minims (1.0) three times a day—camphoric acid—15 to 30 grains (1.0 to 2.0)—given in powder or in spirits 2 or 3 hours before the sweat is expected may be prescribed for this symptom and in excessive instances a hypodermatic injection of $\frac{1}{4}$ (0.016) grain of morphine with $\frac{1}{100}$ of a grain (0.0006) of atropine is often effectual. Muscarine, 5 minims (0.33) of a one percent. solution, picrotoxin $\frac{1}{60}$ of a grain (0.001), agaricin, $\frac{1}{8}$ to $\frac{1}{4}$ of a grain (0.008 to 0.016) and agaric acid in similar dose have all been recommended.

The diarrhœa of phthisis, before there is tuberculous inflammation of the intestine, may be controlled by bismuth subsalicylate or subnitrate gr. xx (1.33) 3 times a day. Later in the disease larger doses may become necessary. If the diarrhœa is persistent a little opium may be given and better results may follow the use of bismuth tetraiodophenolphthaleinate—gr. v to viii (0.33 to 0.5)—than are obtainable with the commoner bismuth salts. If the diarrhœa is the result of tuberculous involvement of the bowel it is likely to be persistent and, in addition to the above means, irrigations and larger doses of opium given with the salts of lead, silver or zinc, may be prescribed.

Tuberculin has been persistently employed as a therapeutic agent by a certain number of observers but has never been in general use. It is probably harmless and the earlier it is employed and the less general the infection the more likely will it be to achieve benefit. It is said to be contra-indicated if either fever or hæmoptysis is present. The preparation employed should be the tuberculin residuatum or tuberculin R. which is potent to produce immunization and, if administered carefully, will cause no reaction. The initial dose is 15 minims (1.0) of a solution of 15 grains (1.0) of tuberculin R. in 1 pint (500.0) of normal saline. This solution should be freshly prepared—within 24 hours of the time of administration. A dose should be injected into the muscular tissues of the back every other day. If there results a rise of temperature the succeeding dose should be postponed until this has disappeared. The patient, after repeated injections,

usually is able to take much increased doses without reaction and with, perhaps, improvement in his condition.

In the light of our most recent knowledge it has become necessary to take into consideration the opsonic power of the blood when administering tuberculin and other such substances as a therapeutic measure. The opsonins are certain bodies which are contained in the serum of normal blood and in whose presence the phagocytic power of the leucocytes over pathogenic micro-organisms in the blood stream is much more potent than when these bodies are absent. The term opsonic index has been employed to designate the relative amount of opsonins in the circulation, consequently a patient whose blood contains them in considerable quantity is said to possess a high opsonic index and *vice versa*.

Tests have shown that in the tuberculous the tuberculo-opsonic index is below normal. By comparing the resistance of the opsonic power of a patient's serum with that of the serum of normal individuals it has been demonstrated that in all infectious processes times occur when the patient's resistance is on the increase and other times when it wanes. In the latter condition the introduction of bacterial vaccines corresponding to the infective micro-organism present still further lowers the opsonic index and the patient's power of resistance is correspondingly lessened. In view of this fact the immunizing substance should be given during the periods of high opsonic index, thus endeavoring to maintain the anti-bacterial power of the blood at as high a level as possible by observing the condition of the opsonic index and regulating the time and amount of dosage in accordance with its variations. Experimentation has shown that much smaller doses of "new tuberculin" than are usually given produce the maximum immunizing response without causing constitutional disturbance, and in consequence, a dosage equivalent to $\frac{1}{60000}$ to $\frac{1}{36000}$ of a grain ($\frac{1}{1000}$ to $\frac{1}{600}$ of a milligram) of tubercle powder are recommended; such doses, when given corresponding to the rises and falls of the opsonic index and, in connection, with means calculated to increase the flow of blood and lymph through the diseased area, which latter aid in increasing the action of the antibodies upon the bacteria present, promise well and seem to imply that this method of treatment will prove a distinct advance in the combat against tuberculous infection, particularly those forms which affect the bones, joints and lymphatic system. It is also quite clear that the treatment is worthy of a careful trial in the pulmonary forms of the disease.

Serum treatment, however, has not as yet given any results which justify its employment to the exclusion of other methods. Favorable reports have been published upon the use of the serums of Marmorek and Maragliano. In October, 1905, at the International Tuberculosis Congress, von Behring stated that he had found a method by the use of which he was able to per-

manently immunize calves and that he had succeeded in rendering the process applicable to human beings. The substance employed is an attenuated culture of tubercle bacilli from which certain injurious elements are removed, transforming it into an amorphous state, in which condition it is directly absorbable into the lymphatics of the organism. This method of treatment is at present *sub judice.*

Apropos of the International Congress, Cheinisse has recently been quoted as saying that: "Serum therapy was the subject of a great number of communications, but the many disappointments which everyone has in mind make us skeptical, and the very multiplicity of 'serums' and 'new tuberculins' recommended in the treatment of tuberculosis is the best possible proof of the inefficacy of every one of these pretendedly specific remedies."

Tuberculosis of the Lymphatic Glands.

Synonyms. Scrofula; Tuberculous Adenitis; King's Evil.

Ætiology. Tuberculous inflammation of the lymph glands may occur at any age but is most frequently met in children. All catarrhal affections of the mucous membranes are predisposing causes, the tubercle bacilli which find lodgment upon the diseased surfaces being taken up by the lymph circulation and deposited in the adjacent lymph ganglia which explains the occurrence of involvement of the submaxillary and cervical glands in instances of naso-pharyngeal or tonsillar inflammations, of the bronchial and mediastinal glands after measles or whooping cough and of the mesenteric glands as a result of catarrh of the intestines.

The specific cause of tuberculous adenitis is the *bacillus tuberculosis.*

Symptoms. The glandular involvement may be either general or localized. The former is rare but has been observed, and particularly in the colored race. The appearance resembles that of Hodgkin's disease, there being enlargement of the cervical, submaxillary, axillary and inguinal glands with pain and tenderness, and *post mortem* examination reveals an analogous state of the bronchial, mesenteric and other internal lymph nodes. There is a febrile movement and death may take place from the pressure of the enlarged ganglia upon the bronchi or trachea or from associated disease.

Enlargement of the bronchial glands is frequent in pulmonary tuberculosis; the condition may be so pronounced as to be recognized *intra vitam* or in less marked instances is not disclosed until after death.

Local tuberculous inflammation of the lymph glands is most frequent in those of the cervical region. It is common in children, especially those of delicate constitution and whose surroundings are unsanitary. It may follow the glandular enlargements which occur as a result of tonsillar enlargement, inflammations of the ear and pediculosis or eczema of the scalp. The glands

are at first firm in consistency and discrete, later they become matted together into a diffuse mass and finally they may soften and suppurate, and becoming adherent to the overlying skin, rupture externally and discharge their contents. There is an irregular febrile movement, and the patient is poorly nourished. In certain instances the glandular involvement extends to the lymph nodes beneath the clavicle, those of the axilla and even to the bronchial ganglia; these last tend to undergo caseous degeneration rather than to suppurate. A unilateral inflammation of the axillary glands may be the precursor of a tuberculous involvement of the pleura or lung.

Involvement of the mesenteric or retro-peritonæal glands (*tabes mesenterica*) occurs as a result of tuberculous enteritis or primarily in simple catarrhal inflammations of the intestine. The latter form is especially common in children. The patient is emaciated and anæmic, the abdomen is prominent and tympanitic and diarrhœa with foul-smelling movements is present. The febrile movement is moderate. Palpation reveals the presence of the enlarged glands, more rarely of tuberculous deposits in the peritonæum itself. Death takes place from intercurrent disease or from exhaustion.

In adults tabes mesenterica is less frequent but may occur primarily or secondary to pulmonary tuberculosis.

The tuberculous glands of the mesentery and those of the retroperitonæal region tend rather to undergo cheesy and calcareous degeneration than to suppurate.

The diagnosis of tuberculous adenitis from Hodgkin's disease (pseudo-leucæmia) is usually not difficult. In the former the glandular involvement is less likely to be general, the glands tend more to become massed together, to become tender and to suppurate, while in the latter they are more movable and less adherent to the surrounding tissues.

The examination of the blood will differentiate tuberculous glandular enlargement from that of lymphatic leucæmia and the glands of simple lymphoma are harder, more discrete, less tender and less likely to become inflamed; likewise constitutional symptoms are absent. Malignant disease is more rapid in its progress and attended by cachexia and metastases if sarcomatous, while in carcinoma we have the primary growth to which the glandular enlargement is secondary.

The prognosis of cervical adenitis is usually good, but that of tabes mesenterica is distinctly bad. Many instances of acute tuberculosis are said to result from the glandular form of the disease.

Treatment consists in the employment of the general measures, hygiene, fresh air, feeding, tonics, etc., mentioned under the treatment of chronic pulmonary tuberculosis and especially the administration of iron iodide—15 minims (1.0); iodine, locally in the form of the tincture painted on, the compound iodine ointment or as iodine-vasogen, seems to have a certain in-

fluence in lessening the glandular enlargement. The internal administration of codliver oil is also to be recommended.

Rather encouraging results have been reported from the X-ray treatment of tuberculous glands of the neck and in the opinion of certain observers the prospect of success is sufficient to warrant the employment of this means. Suppurating glands should, however, be incised and evacuated; the sluggish sinuses which so often persist may be benefited by the application of the X-ray which seems to stimulate the healing process.

The early surgical treatment of tuberculous glands consists in their removal by dissection, often a difficult and prolonged operation.

Tuberculosis of the Pleura.

Tuberculous involvement of the pleura occurs primarily in two chief forms: *a*, with a sero-fibrinous exudate which is likely to be blood tinged; *b*, with a purulent exudate.

Either of these may be acute in course or slow of evolution. They are usually associated with tuberculous infection of the lung but in certain instances may precede the incidence of the latter.

Secondary tuberculous pleurisy occurs in an acute and a chronic form. The former is the result of the extension of the inflammation involving the adjacent pulmonary tissue and may be characterized by the exudation of fibrin, serum or pus. The latter is characterized by the exudation of fibrinous exudate which becomes organized and, with the accompanying cell proliferation, results in marked pleural thickening and adhesions. This newly formed tissue is subject to tuberculous infiltration.

Symptoms. These are identical with those of the various forms of non-specific pleurisy (see p. 656), with the addition of the manifestations due to the accompanying tuberculous involvement of the lung. The physical signs also differ in no way from those of simple pleurisy.

Treatment consists in the employment of the methods applicable to pulmonary tuberculosis in general and in the evacuation of the accumulated fluid by aspiration, if serous, or if purulent by incision and the excision of a rib if necessary.

Tuberculosis of the Peritonæum.

The peritonæal membrane may be the seat of tuberculous disease which manifests itself in the following forms:

a. A non-inflammatory form in which the miliary tubercles are scattered through the visceral and parietal layers of the peritonæum.

b. An inflammatory type in which the tubercles are associated with proliferation and adhesions of the two layers of the membrane which may pro-

ceed to obliteration of its cavity, or there is pronounced thickening with less tendency to adhesions. The mesentery is infiltrated, the omentum is greatly thickened and contains deposits of tuberculous tissue and similar areas may occur in the peritonæal coat of the intestine and that portion of the membrane which envelops the spleen and liver; the disease may occur with hepatic cirrhosis. Serous, bloody or purulent fluid may be present in the general peritonæal cavity or collections may be walled off by adhesions.

The disease may occur at any age and is especially frequent in the colored race. Children, subject to catarrhal affections of the bowel, and young adults are often affected.

Symptoms. Tuberculous peritonitis may exist without being evidenced by any symptoms whatever. In other instances these may appear with such suddenness as to suggest an internal hernia which has become strangulated; in still others the disease may resemble a simple acute peritonitis or enteric fever. The temperature in the more acute instances is elevated but in others the febrile movement may be almost wholly absent. The patient's nutrition may be but slightly impaired. Abdominal tenderness may or may not be present. Physical examination reveals a great variety of conditions, tympanites and ascites are frequent and a stiff, rigid abdominal wall is considered characteristic of the disease. Sacculated collections of fluid walled by adhesions may be detected and nodular firm masses may be demonstrable.

The diagnosis offers many difficulties unless examination of the other organs and tissues reveals associated tuberculous involvement. The tuberculin test may be employed to clear up doubtful instances.

Treatment consists in the employment of the measures already suggested to increase the patient's nutrition and power of resistance. The febrile movement may be controlled as suggested upon p. 180. Diarrhœa should be controlled by intestinal antiseptics and laxatives may be prescribed when indicated. The abdominal pain may be relieved by the local use of the tincture of iodine or the actual cautery. Inunctions of ichthyol 4 parts, belladonna extract 2 parts, mercurial ointment, vaseline and lanolin each 10 parts or applications of guaiacol 1 to 2 parts, tincture of iodine 15 parts, glycerin 20 parts may be employed. Iodine-vasogen may also be employed as an inunction. The use of the ice bag may assist in relieving the pain as may also rubbing with a mixture of chloroform 10 parts, hyoscyamus extract 10 parts, camphorated oil and lanolin of each 25 parts.

Marked ascites should be relieved by aspiration and, in certain instances, considerable benefit has followed laparotomy.

Tuberculosis of the Pericardium.

Tuberculosis of this structure occurs less frequently than similar affections of the pleura and peritonæum. It may be either primary or secondary. The

condition may be unrecognized during life and cause no characteristic symptoms or it may manifest the symptoms of acute pericarditis with the effusion of serous, sero-sanguinolent or purulent fluid. In other instances the inflammation is characterized by adhesions of the pericardium with accompanying symptoms of cardiac dilatation and hypertrophy and various cardiac murmurs. Acute tuberculosis may result from a primary tuberculous involvement of the pericardium.

Tuberculosis of the Kidney.

Pathology. Tuberculosis of the kidney occurs, either associated with general tuberculous infection, in which there are miliary tubercles scattered through the organ, or as an affection characterized by areas of tuberculous degeneration which are prone to coalesce and to become cheesy and softened, spreading so that the entire kidney is converted into a caseous or purulent mass. Such a condition may be secondary to tuberculous prostatitis, cystitis, ureteritis, or pyelitis and may spread also to the epididymis or testicle, ovary or tubes. One or both organs may be involved.

Symptoms. Miliary tubercles may be present in the kidney without causing any especial symptoms. In the second type of the disease the symptoms consist of the passage of purulent urine which may contain blood from time to time. Micturition is usually frequent and there may be dull lumbar pain. The patient usually loses flesh and strength and suffers from chilly feelings and irregular rises of temperature. Tuberculosis of the lungs or of other organs is very frequently present.

Palpation of the region of the kidney causes pain and the kidney itself may be felt. A large tumor is seldom made out but if the pelvis of the organ is distended with pus this may be detected as a fluctuating mass.

The urine contains pus, epithelial cells, cheesy masses, and at times, red blood cells. Casts are seldom seen but albumin is present due to the presence of the pus cells. The reaction is more usually acid than in cystitis and, upon sedimentation by means of the centrifuge and staining by the ordinary methods, tubercle bacilli may be found, assuring the diagnosis. If there is doubt as to which kidney is involved the catheterization of the ureters is a simple matter to the skilled hand.

Treatment, aside from the employment of the usual means to improve the patient's general condition, is entirely surgical. If only one kidney is affected it may be removed *in toto* or if but a few tuberculous nodules are found these may be excised and the kidney restored to place.

Tuberculosis of the Pelvis of the Kidney, Ureter and Bladder.

The symptoms of these conditions are in no way to be distinguished, except by the detection of the tubercle bacillus in the urine, from simple inflam-

mations of these structures. Frequency of urination, pyuria and occasional hæmaturia are the principal manifestations. Finding the tubercle bacillus in the urinary sediment does no more than to prove that there is tuberculous infection of the genito-urinary tract, it does not distinctly locate its position. Cystoscopy is of some aid and by means of this and the searcher we should be able to eliminate calculus. Ureteral catheterization which draws a non-purulent urine should prove the freedom of the ureters from disease, but it is doubtful if it is advisable to risk infecting these structures by catheterizing them through a diseased bladder. Still this is a matter for the specialist to decide and the procedure may be without danger if the bladder is previously washed and then filled with an antiseptic solution. A persistent cystitis of iodiopathic origin is always suspicious, particularly if there is tuberculous involvement elsewhere in the body.

Treatment consists in attending to the patient's general condition and the employment of the usual means, irrigations, etc., applicable in cystitis. Unfortunately hexamethylene seems less capable of destroying the tubercle bacillus than other pathogenic organisms in the urine.

Tuberculosis of the Testicles, Prostate Gland and Seminal Vesicles.

Tuberculosis of the testes and prostate gland occurs as a caseous degeneration which seldom proceeds to liquefaction. Testicular tuberculosis is not rare and may be either primary or secondary to tuberculous disease of other parts. It is seen in children and in adults and has been observed in the fœtus. The epididymis is usually first invaded whence the affection spreads to the testicle itself; the organ is enlarged, later becomes softened and ulcerated, and fistulæ, the walls of which are infiltrated with tuberculous tissue, are formed. The condition may be mistaken for syphilis; both are painless but the latter affects primarily the body of the testis in which are situated irregular nodules of a stony hardness. In prostatic tuberculosis the gland is nodular, the nodules being palpable upon rectal examination, there is vesical irritability and catheterization is painful and difficult.

Treatment aside from the employment of general measures is surgical.

Tuberculosis of the Ovaries, Uterus, and Fallopian Tubes.

Tuberculosis of the tubes is the most frequent of these affections and may occur primarily. The diseased tube is enlarged, infiltrated and hard and contains mucus, pus and caseous matter. Abscesses, followed by peritonitis, may occur. Both tubes are usually involved.

Ovarian tuberculosis is usually secondary to tubal disease; the organ may be infiltrated with tubercles or caseous areas, which may form abscesses, may be present.

Uterine tuberculous disease is rare and may be primary; usually, however, it is secondary to disease of the tubes or vagina. The wall of the organ is infiltrated with tubercles and its mucous lining is thickened. The tubercles may undergo degeneration which results in ulceration and metritis, the symptoms of which differ in no way from uterine inflammation due to other causes.

Tuberculosis of the Mammary Gland.

This affection may occur in either sex but is by far more common in women; it is most frequent between the ages of 40 and 60. Tubercles are deposited in the glands; these degenerate and soften, breaking through the skin and form suppurating fistulæ, in the walls and discharge of which bacilli may be found. The axillary glands may be enlarged. Cold abscesses of the breast may occur. The course of the disease is usually protracted, but recovery is possible under proper constitutional and surgical treatment.

Tuberculosis of the Heart and Blood-vessels.

Tuberculous disease of the myocardium with tubercles in the substance of the muscle may occur as part of acute general tuberculosis; caseous degeneration is very infrequent.

Secondary tuberculous endocarditis due to a mixed infection may be observed in pulmonary tuberculosis and a verrucous endocarditis with tubercles in the valvular vegetations has been observed.

Primary tuberculous disease has been found in the wall of the aorta in rare instances and the disease may involve, by extension, the vessels of diseased tissues; such inflammation weakens the vessel wall and perforation with hæmorrhage may result.

ACUTE INFECTIOUS PNEUMONIA.

Synonyms. Croupous Pneumonia; Pneumonitis; Lung Fever; Lobar Pneumonia; Fibrinous Pneumonia.

Definition. An acute, infectious inflammation of the lungs, rendering the involved portion of the organ impervious to air, and characterized by a chill, fever, dyspnœa, rusty sputum, and prostration.

Ætiology. Acute infectious pneumonia is common in all countries. It occurs chiefly in adults and is most frequently seen during the cold and damp seasons of the year. Males are more prone to the disease than females, probably because of the greater liability to exposure of the former. Alcoholism, debilitated conditions and exposure to cold and wet are predisposing factors. One attack is likely to predispose to another. At times the disease seems to occur epidemically.

The specific cause of the disease is probably infection by either the *micro-*

coccus lanceolatus or diplococcus of Fränkel, or the *bacillus pneumoniæ* of Friedländer or both these together. Streptococci, staphylococci and various other micro-organisms may be found in pneumonic sputa as the result of a mixed infection. It seems to be the accepted idea at present that a number of different bacteria are capable of producing the disease.

Pathology. In lobar pneumonia the pathological anatomy may be divided into three stages.

a. Congestion or hyperæmia.

b. Red hepatization or exudation.

c. Gray hepatization or resolution.

The lower lobes are most frequently affected, but involvement of the upper lobes is not rare, and even the whole of one lung may become the seat of the morbid process. When the upper lobes are involved the disease is usually of severe type.

During the stage of congestion the lung is œdematous but not consolidated and in the air spaces are leucocytes, red blood cells, fibrin and epithelium. The vessels in the walls of the alveoli are distended. The small bronchi undergo a like change, but the larger bronchi may or not be involved. The pleura as a rule remains normal. The first stage usually lasts only a few hours but may continue throughout several days.

When the first stage has reached its height the air spaces and bronchi which are the seat of the inflammation are filled with its products and the lung becomes solid, the stage of red hepatization. The air vesicles, spaces and bronchi are plugged with the red blood cells, leucocytes and fibrin, but the vessels of their walls are not rendered impervious. The pleura over the affected lobe is the seat of a fibrinous pleurisy. The solidified lobe is enlarged so that it may interfere with the action of the other lobes; about 25 percent. of the fatal instances die in this stage from one to ten days after the onset of the disease.

After the air spaces have become filled and the lobe is solidified the third stage ensues. The inflammatory material becomes gray in color and softened. The lung remains solid. If the patient recovers the exudate continues to soften and disintegrate, the stage of final resolution begins and the lymph circulation carries off the inflammatory products. Resolution should begin when the temperature falls to normal and should be complete in a few days. The stage of transition between red and gray hepatization takes place between the second and eighteenth days of the disease. About 50 percent. of the fatal instances die in this stage.

If perfect recovery takes place the lung is restored to its original condition.

Symptoms. In a certain number of patients there are prodromata such as chilliness, slight fever, general malaise and a sense of oppression, due probably to a lengthened first stage or period of congestion, but in a great proportion

of instances the disease is ushered in by one or more distinct chills. The temperature immediately rises and continues elevated, with morning remissions. until defervescence. Sudden rises in temperature during the course of the disease usually mean an extension of the inflammation or the onset of a complication. When the inflammation affects the upper lobes the temperature is likely to be especially high. Certain patients, especially old persons, show very little rise of temperature, but this does not indicate a mild attack.

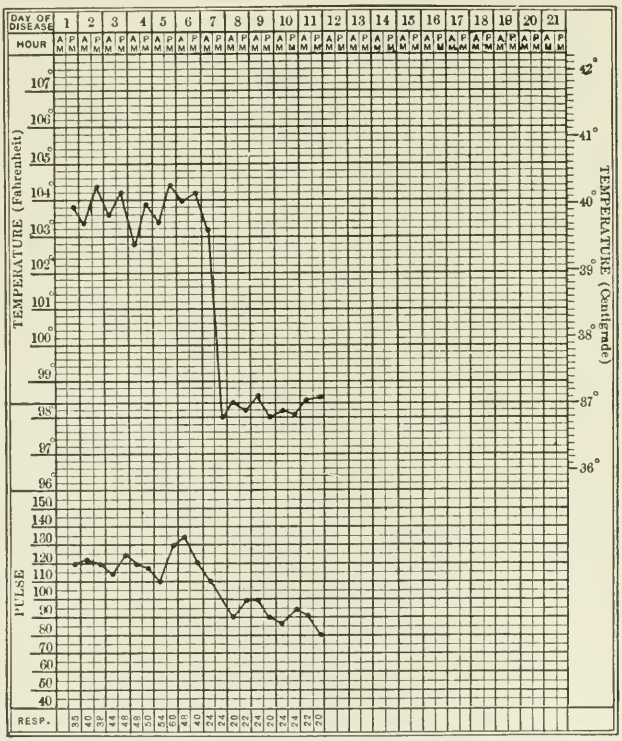

FIG. 7 —Clinical chart of acute infectious pneumonia.

Defervescence usually takes place by crisis on the seventh day, but may occur earlier or later, crises on the fifth, ninth, or eleventh days being not rare. In other instances the defervescence takes place by lysis—this being particularly likely to occur in the pneumonia complicating epidemic influenza—the fall to normal extending over a number of days.

The pulse is at first full and rapid, later becoming weaker as the heart is embarrassed by the obstruction to the passage of the blood through the lungs and by the lack of oxygen due to the diminished respiratory surface.

The respiration is rapid and shallow and, as the disease progresses, varies with the amount of lung involved; the inspiration is short and may be accompanied by a grunting sound. The normal pulse-respiration ratio (4 to 1) is disturbed, a ratio of two pulse beats to one respiration being not infrequent. Very labored breathing indicates large involvement of pulmonary tissue, marked congestion, severe bronchitis, tendency to heart failure or inflammation of the pleura or pericardium.

With the onset there is usually sharp stabbing pain in the chest, increased on coughing or inspiration, which may be due to pleuritic inflammation.

Cough may be an early symptom or appear later in the disease. In the aged, especially, it may be absent. The sputum is a blood stained muco-pus, (the so-called "rusty sputum") and very viscid, so much so that it adheres tenaciously to the sides of the containing vessel. In severe infections the sputum may be thin and dark colored—"prune juice"—and large in quantity. As resolution takes place the sputum becomes lumpy and yellowish or greenish. In certain patients and not infrequently in old persons there may be no expectoration.

From the onset the prostration is marked, the face assumes a characteristic expression of anxiety and there is usually a deep flush over the malar bones. Herpes labialis is not rare, and cyanosis of the lips and extremities may occur when there is marked obstruction to respiration.

At the invasion there are often nausea and vomiting; the tongue is moist and coated. In severe infections it becomes dry, brown and cracked.

Headache and general pain are common early symptoms. In severe types of the disease delirium and stupor are often seen. In alcoholic patients the infection is especially virulent and is usually accompanied by marked delirium, often by delirium tremens.

The urine is scanty, hyperacid and diminished in quantity. It may contain albumin and casts and its chlorides are diminished.

A distinct leucocytosis is a feature of this disease.

Physical signs. Inspection. First stage: Respiratory movement is likely to be diminished on account of pain. *Second stage:* The normal side of the chest moves as in health, movement in the affected side is diminished. If both lower lobes are involved the movement of the diaphragm is interfered with and the respiratory movement is most apparent in the upper part of the chest.

Palpation. First stage: The vocal fremitus is slightly increased. *Second stage:* The vocal fremitus is distinctly increased as a rule, rarely diminished or absent, probably due to occlusion of the bronchi by inflammatory products.

Percussion. First stage: Usually the note is unchanged, but it may be higher in pitch, shorter in duration and less distinctly pulmonary in quality. *Second stage:* The note is now more or less dull, though it may be flat,

tympanitic or even cracked-pot. If the pleural cavity contains fluid, over this the note will be flat.

Auscultation. First stage: The respiratory murmur may be harsh or diminished. There may be subcrepitant râles due to the exudation into the small bronchi and coarse râles with sibilant and sonorous breathing due to inflammation of the larger tubes. *Second stage:* In most patients both voice and breathing over the consolidated lobe are bronchial but there may be bronchial voice without bronchial breathing or both voice and breathing may be absent. *Third stage:* As resolution progresses the breathing becomes broncho-vesicular, and subcrepitant and coarse râles in the bronchi are heard, due to the presence of the softened products of the inflammation. As resolution continues normal vesicular breathing becomes more apparent and the percussion note approaches nearer to pulmonary resonance. The dulness is the last of the physical signs to disappear, it often remaining to a slight extent long after the patient has recovered.

Complications. Of these *pleurisy* is the most common, indeed it occurs whenever the pneumonic process reaches the surface of the lung and accordingly is so frequent as hardly to deserve the dignity of being numbered with the complications. To it is due the severe pain of the early stages and it is evidenced by the typical friction sounds, which, however, may be obscured by the other physical signs present. Effusion of serum into the pleura is not rare and may go on to empyema, in the pus of which pneumococci are usually found; in infrequent instances streptococci may be present. Purulent fluid is accompanied by a septic temperature with rigors and sweats and an increased leucocytosis. The physical signs are those of fluid in the pleural cavity. If there is doubt the use of the aspirating needle is justifiable.

Pericarditis is occasionally observed and is easily overlooked; the fluid is usually of small quantity and serous in most instances; rarely it may be purulent.

Endocarditis is not very rare and is of the malignant type. It is especially likely to occur if there has been previous disease of the heart. The physical signs may be absent but if the temperature persists and becomes of septic character, if signs of embolism appear, or if a cardiac murmur develops, involvement of the heart should always be suspected.

Meningitis is a serious but not very common complication. The most usual time for its appearance is while the fever is at its highest and it may not be recognized, being masked by the cerebral symptoms of the disease. Endocarditis may be co-existent and, as a result of this latter, there may be cerebral embolism with its accompanying symptoms.

Complications which are infrequently met are neuritis, jaundice, parotitis, thrombosis of the peripheral veins, usually those of the leg, and peritonitis.

In considering the complications of pneumonia that form of the onset of

the disease which is marked by *abdominal pain* may be mentioned. In some instances the symptoms referable to the lung, if present at all, are wholly subordinate to severe pain in some part of the abdomen. If this occurs in the appendiceal region inflammation of the underlying structure may be suspected. The pain may also be localized near the navel or deep in the epigastrium and suggest hæmorrhage into the pancreas.

The diagnosis is easy when the physical signs are typical, pleurisy with effusion being more usually mistaken for lobar pneumonia than any other disease. In the latter condition, however, vocal fremitus is increased, while in the former it is absent and the constitutional symptoms are much less severe. The aspirating needle may be used if necessary. In pneumonia there is an increased leucocytosis, while in pleurisy, unless the fluid is purulent, this is not the case. Pneumonic sputum usually contains the specific micro-organism of the disease which will aid in the differentiation from tuberculous conditions.

The prognosis should be guarded, the outcome of the disease depending in great measure upon the age of the patient, his previous condition, and upon the extent of lung affected. Involvement of the upper lobes is considered more serious than that of the lower. Death usually takes place as a result of cardiac failure or of one of the complications, meningitis and endocarditis being particularly likely to cause a fatal termination. Under the treatment to be described the mortality should be much lowered.

Prophylaxis. Pneumonia has recently become classified as one of the infectious diseases, consequently all discharges, especially the sputum, which may contain the contagium, should be treated as usual in infectious conditions and, as an additional precaution, rooms which have been occupied by pneumonia patients should receive proper fumigation before being again occupied. Cleanliness on the part of the nurse and physician should also be maintained as strictly as in the handling of the more virulently contagious diseases.

Treatment. From the onset of the disease the patient should be confined strictly to bed and not allowed to rise for any consideration, sudden attacks of heart failure having been known to occur as a result of so slight an exertion as merely sitting up in bed. The patient should wear a flannel night gown or shirt which should open behind to facilitate examination of the chest. The room should be large, light, well ventilated and kept at a temperature of from 65° to 70° F. (18.3° to 21.1° C.). At the onset of the disease calomel should be administered, followed by a saline, and throughout the infection the bowels should be kept freely open.

Medicinal treatment should be directed 1, toward limiting the infection; 2, toward overcoming the mechanical disadvantages; 3, toward the elimination of the products of the bacterial cause of the disease.

In the exhibition of creosote carbonate we have a means of limiting the

infection as proven by the statistics of various authorities. This drug cuts short or aborts a large percentage of instances, mitigates almost all the rest, and in a small proportion of patients no result is obtained. Certainly if the early appearance of the crisis is any indication of the value of the treatment this remedy is deserving of a trial. Unlike creosote itself the carbonate is not disturbing to the kidneys or stomach even when administered for considerable periods of time. The usual dose is from two to four drachms (8.0 to 16.0) daily, the dose interval being six hours, but to a vigorous man as much as one-half a drachm (2.0) every two hours may be given. It may be given in milk, sherry, or pure. The medication should be continued until the temperature has remained normal for four or five days, but when the febrile stage is passed the dosage may be reduced one-half.

The mechanical obstruction to the circulation is best combated by the use of nitrites (glyceryl nitrate or sodium nitrite). These relieve the high tension in the pulmonary circulation to a slight extent and that of the systemic circulation markedly.

Of late erythrol tetranitrate in doses of one-half grain (0.032) every four to six hours has given more even and controllable effects than the evanescent glyceryl nitrate or the uncertain sodium nitrate. Hypodermatic stimulation by strychnine nitrate or sulphate in doses of from one-fiftieth (0.0012) even to one-tenth of a grain (0.006) every four to six hours may be employed as indicated, and continued until the desired result is obtained. The heart should be carefully watched for signs of dilatation and when these—weakness of the pulse and of the second pulmonic sound—appear the stimulation is necessary. Care should be taken not to mistake the appearance of defervescence for threatened cardiac weakness, for at the crisis the second pulmonic sound loses its booming character on account of the lessening of the tension in the pulmonary circulation consequent upon beginning resolution.

Alcohol as a stimulant should usually be confined to patients accustomed while in health to it. The amount given should be gauged by the patient's condition and may even reach a quart (litre) per day. Ammonium carbonate in 10 grain (0.66) doses, in 2 ounces (60.0) of milk every 2 hours, replaces the strychnine in the aged. Excellent results are claimed for and obtained by veratrum viride in the very early stages of the disease occurring in young or even middle-aged individuals, but unfortunate results are quite as frequent as successes with this drug and it is to be employed exceptionally only. To bleeding the same remarks, though perhaps, more stringently, will apply. It is also well known that venesection does not give as good results in pneumonia as in cyanosis with dilated right heart due to other causes. This observation leads us to question as to how much the pressure in the pulmonary artery is raised by extensive pulmonary consolidation.

Toward elimination of the products of the bacteria causing the disease we

can do much by means of high rectal irrigations of normal (0.9 percent.) saline solution, one gallon (4 litres) at 112° F. (44.4° C.) given twice daily. It is particularly potent in patients with complicating renal disease. It is a most valuable method of provoking diuresis, stimulating the heart, cleaning the large intestine and, to a less extent, producing diaphoresis. One-sixth of a grain (0.011) of calomel every hour for six doses, with saline laxatives sufficient to empty the bowels completely and keep them open afterward, with from three to six grains (0.2 to 0.4) of zinc phenolsulphonate every two to four hours, may be administered with benefit. When the odor has disappeared from the stools the zinc salt should be given in doses just sufficient to prevent fœtor and, if constipation occurs, a second course of calomel followed by a saline may be prescribed until the stools are odorless. It is true, however, that under the creosote treatment tympanites is rare and the necessity for intestinal disinfection is much lessened.

Oxygen is of value if the respiratory surface is much decreased and its inhalation is advocated by many as a valuable curative measure. It gives ease to the patient, relieves the cyanosis, the failing heart and the laboring respiration, and may induce sleep. The best method of administering it is to arrange a funnel attached to the container in front of the patient's nose and mouth. It must be given for considerable periods at a time and to some patients incessantly. Certain observers advocate its intermittent use from the beginning of the disease on the ground that it is likely to ward off respiratory failure.

Expectorants when necessary may be prescribed, the preference to be given to apomorphine hydrochloride $\frac{1}{32}$ of a grain (0.002) every 4 hours.

Acute infectious pneumonia in the aged is a very serious disease on account of the tendency of old persons to heart weakness and pulmonary hypostasis. Free stimulation is likely to be necessary and the patient should be rolled from one side to the other several times a day. It is the author's custom, when the stomach will bear the drug, to administer 10 grains (0.66) of ammonium carbonate in 2 ounces (60.0) of milk 3 times a day to these patients.

Local applications which interfere with the patient's comfort are to be avoided. A pneumonia jacket of cotton batting overlaid by oiled-silk is pleasing to many and, if pleuritic pain be present, a layer of cataplasma kaolini spread on the chest and covered with layers from a roller bandage often affords relief. A liniment of equal parts of menthol, hydrated chloral and camphor well rubbed in at the seat of the pain is also useful. In very marked pleuritic pain hypodermatic injections of morphine may become necessary.

The headache and delirium may be mitigated by the use of the ice helmet.

Treatment by means of an antitoxin has been extensively attempted but the results, as a whole, fail to carry conviction. An efficient serum, or one which will shorten the disease, has not yet been elaborated but in the opinions

of certain observers the serums at present available have a limited use. The results so far attained by the use of treatment by antitoxin have modified the mortality to scarcely sufficient degree to warrant its universal employment. The serums thus far elaborated possess no antitoxic qualities and that they possess anti-infectious properties has yet to be proved. Notwithstanding the discouraging results attained up to this time in the attempt to discover a potent treatment for pneumonia along this line, further research is to be encouraged.

Diet. Milk, preferably peptonized or diluted with Vichy or lime water, or the fermented milks, kumyss or matzoon, should be our chief reliance. The preparations of the meats in the form of extracts may be allowed.

Taking all into consideration the treatment of pneumonia is especially satisfactory. In fine we should rely upon: 1. The continuous, persistent and generous administration of creosote carbonate. 2. Careful adjustment of mechanical conditions. 3. Thorough evacuation of toxins by all possible means. 4. Temporary supplemental oxygen by inhalation. 5. Liquid diet until all physical signs disappear.

BRONCHO-PNEUMONIA.

Synonyms. Catarrhal Pneumonia; Capillary Bronchitis; Lobular Pneumonia.

Definition. A disease of the lungs caused by microbic infection and characterized by areas of consolidation of varying size scattered through the lung, each surrounding a bronchus.

Ætiology. It is this form of pneumonia which occurs most frequently in children; it is also prone to attack the aged.

The disease may occur primarily as a result of exposure; especially is it predisposed to by catarrhal affections of the air passages and particularly by the presence of adenoids and enlarged tonsils.

Secondarily broncho-pneumonia occurs as a complication of the acute infectious diseases particularly those to which children are prone, measles, scarlet fever, diphtheria and whooping cough, which accounts for the numerous instances of the disease during the early years of life. It may occur secondary to bronchitis in adults as well as in infants and, in the former, especially in old age, it may complicate the infectious diseases and various chronic affections such as nephritis and endocarditis.

The so-called foreign-body or inhalation pneumonia is a variety of broncho-pneumonia; this type of the disease is caused as follows: In comatose states or when for any other reason the sensibility of the glottis is impaired, particles of food or drink may pass into the trachea and thence into the smaller bronchi where they cause irritation, subsequent inflammation and even sup-

puration and gangrene. Inhalation pneumonia may follow operations upon the pharynx or larynx, and the inhalation of particles of blood clot raised during hæmoptyses; it may occur in individuals whose occupations necessitate the respiration of air impregnated with dust, such as coal miners, stone-cutters, etc.

Poor hygienic surroundings and poor sanitary conditions predispose to the incidence of broncho-pneumonia.

The micro-organisms most often associated with broncho-pneumonia are the *streptococcus pyogenes*, *staphylococcus albus* and *aureus*, the *pneumobacillus* and the *micrococcus lanceolatus*. The diphtheria bacillus also may be found if the affection is secondary to diphtheria. Mixed infections are the rule.

Pathology. The surface of the lung, if the areas of consolidation reach the surface of the organ, shows prominences, over which the pleura may be the seat of a fibrinous exudation, and depressions of darker color; the latter representing collapsed lung which may, however, be re-inflated. Other parts of the lung may be the seat of a compensatory emphysema. The projecting areas represent consolidation. These are firm and may be small, consisting of a zone of inflamed tissue surrounding a single bronchus, or large as a result of the coalescence of several such areas. Cross section of the consolidated zones reveals a central spot of lighter color from which pus may be expressed; this is the bronchus the lining of which is the seat of an exudative inflammation. Microscopically the exudate in the consolidated portions of lung is seen to be composed of fibrin, pus and red blood cells and epithelium. The bronchial mucous membrane is swollen and infiltrated with leucocytes; its lumen is blocked by an exudate of mucus, pus and exfoliated epithelial cells. The air cells adjacent to the areas of consolidation are dilated and emphysematous. In adults a later stage of the consolidation may resemble in appearance the gray hepatization of lobar pneumonia and it may finally undergo permanent sclerosis. In inhalation pneumonia the inflammatory process is more pronounced and may be followed by abscess formation or gangrene.

The pneumonic process may terminate in resolution, chronic interstitial broncho-pneumonia (cirrhosis of the lung), suppuration or gangrene, or a secondary infection with the tubercle bacillus may take place, leading to acute or chronic pulmonary tuberculosis.

Symptoms. In the primary form of the disease the onset may be sudden, with a chill, which may be unnoticed, or a convulsion, but more commonly the invasion is gradual with cough, increasing dyspnœa and a rise of temperature. In the secondary type we usually have the symptoms of the primary affection and a cough to which a febrile movement is added—101° to 104° F. (38.5° to 40° C.). The cough becomes more marked, the pulse rapid and the

respiration increased—46 to 60 or even higher—there is dyspnœa and often cyanosis of the face and extremities. As the disease progresses the cough becomes less frequent but the pulse and respiration remain accelerated, the former growing gradually weaker, until death occurs from failure of the right heart. In more favorable instances after a few days the symptoms abate and recovery takes place. Convulsions may occur as a late symptom.

In adults the onset varies but is usually gradual, with cough, rapid pulse, dyspnœa and fever. The diagnosis is usually impossible without physical examination. In inhalation pneumonia the invasion is prolonged and the development of the symptoms slow.

Physical Signs. In certain instances the areas of consolidation may be too small to give distinctive physical signs. Here at first we may have the coarse râles of a general bronchitis, and over a certain part of the lungs, usually in one of the lower lobes posteriorly, coarse sonorous and finer sibilant râles are heard which are soon replaced by fine moist subcrepitant râles with an enfeebled and high pitched respiratory murmur. Larger areas of consolidation give the moist subcrepitant râles which, directly over the solidified portion of the lung, are louder and seem closer to the ear. Here the respiration is higher pitched and broncho-vesicular. The voice is also of increased resonance. The percussion note and vocal fremitus are often unchanged but, if the consolidated zones are of considerable size, slight dulness may be apparent and perhaps slight increase in fremitus. At the center of the solid area the voice and breathing are bronchial, becoming less typically so as the margin of the consolidation is approached. The râles are often absent over the point of maximum consolidation but become more frequent at a distance from this situation. When resolution begins the bronchial voice and breathing are the first to disappear; râles may persist for several weeks. It must be remembered that frequently ordinary respiration will not suffice to render the physical signs perceptible; the child must be made to take deep respirations or to cry.

In old persons the signs are analogous to those in children. When the consolidation involves but a small portion of the pulmonary tissue there may be no sign but fine moist râles. In larger areas of solidification the signs are more marked.

The diagnosis in children may be easily made, especially in the secondary instances of the disease, for a cough, fever, rapid pulse and respiration, with the occurrence of fine moist râles over a portion of the lungs signify broncho-pneumonia and nothing else, but if the consolidated area is large and the physical signs bear a close resemblance to those of acute infectious pneumonia the differentiation from the latter affection may be difficult. In lobar pneumonia the temperature is likely to be persistently high while in broncho-pneumonia it is frequently remittent.

The prognosis is always serious in children, but depends to a great extent upon the previous condition and upon the primary disease if the pneumonia is secondary. In private the patient's chances are far better than in hospital practice. Young infants are more likely to perish than those over 1 year of age. Patients who take nourishment and assimilate well are likely to recover, but those who suffer from digestive disturbances less commonly do well. Convulsions in the latter part of the disease are a serious symptom. Even in children the disease may go on to pulmonary tuberculosis.

In severe infections death may take place within 24 hours; in favorable instances the disease lasts a week or 10 days and is followed by a convalescent period of similar duration.

Treatment. Prophylaxis consists in careful treatment and care for all instances of catarrhal affections of the upper or lower air passages, the removal of adenoids and enlarged tonsils, careful nursing during and avoidance of exposure after all acute infectious diseases and the isolation of broncho-pneumonia patients, when the disease breaks out in hospitals.

The patient should be kept in bed, unless he is small enough to be held in the nurse's arms for some time each day, in a thoroughly ventilated apartment —one with an open fire-place is best—and it is wise to remove him to another room at least twice during the 24 hours, while the sick-room is aired. The food should be of liquids entirely and chiefly of milk. If the child is receiving a modified milk mixture it is well to dilute this with equal parts of water during the acuity of the illness.

At the onset the bowels should be opened by calomel—$\frac{1}{10}$ to $\frac{1}{4}$ of a grain (0.006 to 0.016) of calomel at $\frac{1}{2}$ hour intervals until 6 doses have been taken.

Poultices or blisters should not be applied, the application, however, of a mild mustard paste, of a strength of 1 part mustard to 6 of flour mixed with lukewarm water and put on while warm, is advised. This should be large enough to cover the whole chest, should be applied every 2 to 4 hours and allowed to remain in place until the skin is well reddened, *not blistered.* If fever is absent the pneumonia jacket of cotton batting laid between muslin and oiled-silk, the former being placed next the skin may be worn, but if the temperature is elevated this is best omitted.

The cough may be relieved and the bronchial secretion rendered less tenacious by steam inhalations which are given by means of a croup kettle, the spout of which is passed into a tent made of blankets and arranged over the crib. Either water alone or lime water may be employed in the early stages; later creosote, eucalyptol or compound tincture of benzoin may be added. Each inhalation should last about a quarter of an hour and these may be given as many as 10 times daily, depending upon the patient's condition.

It is very important that the digestion remain undisturbed, consequently

the less medication given by mouth the better; however, we often prescribe creosote carbonate with benefit. A child of 2 years may take from 2 to 3 minims in a spoonful of milk every 3 or 4 hours. If expectorants are deemed necessary, and this is seldom the case, to older children in the first stage we may give antimony and ipecac in minute doses and later one of the stimulating expectorants. The following prescriptions may be useful: ℞, vini ipecacuanhæ ℥ij (8.0), vini antimonii ℥j (4.0), vini xerici ℥iij (12.0). Misce et Signa, 10 drops every 2 hours for a child 2 years old. ℞, ammonii chloridi gr. x (0.66), spiritus camphoræ ℥j (4.0), spiritus ætheris nitrosi ℥ij (8.0), syrupi tolutani ℥iij (12.0), aquæ gaultheriæ, aquæ destillatæ, aa q. s. ad ℥iij (90.0). Misce et Signa, one teaspoonful every hour for a child 2 years old. Too much stress cannot be laid upon the danger of the indiscriminate administration of expectorants and emetics to children. Emetics are allowable only when the secretion is profuse and the cough insufficient to relieve the bronchial tubes; here we may employ the syrup of ipecac in dose of 1 drachm (4.0) for a child of 2 years. Emetics are strictly contra-indicated in severe infections with depressed circulation.

If the cough is distressing small doses of pulvis ipecacuanhæ et opii with the addition of acetphenetidine (phenacetine) if there is high temperature and restlessness—½ a grain (0.03) of the former and 1 grain (0.065) of the latter—may be given to a child of 2 years. To younger children these drugs should be administered with great care on account of their depressing influence upon the heart and respiration and the constipating effect of the opium. Heroine is useful in older children to relieve the cough, the dose for a child of 5 years being from $\frac{1}{100}$ to $\frac{1}{60}$ of a grain (0.0006 to 0.001).

Tincture of aconite in doses of 2 minims (0.13) may be given in the early stages of the disease every two hours, when the pulse is full and bounding, until its effect is noted.

Stimulation is necessary as soon as there is any evidence of circulatory weakness and here our chief dependence must be placed upon alcohol, in the form of brandy or whiskey, and strychnine; 20 drops (1.33) of either of the two former may be given to a patient of from 1 to 2 years old every 2 hours. It should be well diluted with water and the dosage may be increased if necessary. The dose of strychnine for a child of 2 years is $\frac{1}{200}$ of a grain (0.0003) every 2 or 3 hours.

Attacks of respiratory failure should be combated by full doses of strychnine and atropine and the administration of oxygen inhalations. The child may be made to cry, which will cause fuller inspirations of air and freer oxygenation of the blood, by continued spanking or the employment of alternate hot and cold applications of water to the chest; a hot mustard bath is useful in collapse. The repetition of these procedures is often necessary.

Nervous symptoms, restlessness, sleeplessness, etc., may be relieved by small

doses of acetphenetidine and if the fever reaches 105° F. (40.5° C.) or over, cold sponging is useful.

During convalescence tonics, especially codliver oil and the syrup of iron iodide, should be prescribed and in instances of persistent cough small doses of creosote carbonate are very useful. It may be necessary to complete recovery to prescribe a change of climate.

The treatment of the broncho-pneumonia of adults is essentially the same as that of acute infectious pneumonia (see p. 195.) Inhalation pneumonia is usually secondary to other serious disease and while the general treatment is that of broncho-pneumonia, the results are not all that might be desired.

CHRONIC INTERSTITIAL PNEUMONIA.

Synonyms. Cirrhosis of the Lung; Sclerosis of the Lung.

Definition. A chronic inflammatory affection of the lung characterized by an over-growth of fibrous tissue which replaces the normal pulmonary parenchyma. This interstitial change may be either local or diffuse, according as to whether it involves small or large areas of the lung tissue.

Ætiology. This disease is chiefly a secondary affection and occurs with nearly all chronic pulmonary inflammations. In tuberculosis, the fibroid phthisis (q.v.) which at times results, is a form of interstitial pneumonia. It also frequently follows a broncho-pneumonia even in children, very rarely it succeeds acute infectious pneumonia. Chronic interstitial pheumonia occurs as a result of the inhalation of dust by those whose occupations necessitate working in a dust-laden atmosphere. It may be caused by any of the tumors and cysts which may involve the lung and may be induced by pulmonary abscess. Chronic fibrinous pleurisy or pleurisy with effusion may so compress the lung as to lead to fibroid change and the same degeneration follows compression by aneurysmal tumors and the irritation caused by the presence of a foreign body. Microbic infection, in addition to mechanical influences, bears a distinct relation to the production of interstitial pneumonia.

Pathology. The affected lung is shrunken and much retracted within the thoracic cavity and displacement of the heart is usually observed if the affection involves the left lung; pleuritic adhesions are common. On section the lung is dense and firm and of grayish color due to the presence of the fibrous tissue and through this the bronchi and blood-vessels make their course; the former may be the seat of bronchiectatic dilatations, the latter of a sclerotic inflammation. The pulmonary alveoli are to a greater or less extent encroached upon by the over-growth of interstitial tissue. In the tuberculous type of the disease there may be miliary tubercles or cavity formation. There is compensatory emphysema of the uninvolved lung and the right ventricle of the heart is hypertrophied and per-

haps dilated. Microscopically the fibrous infiltration begins in the wall of the bronchi and spreads thence to the alveolar walls, the entire lobule ultimately becoming fibrous and firm. If the interstitial pneumonia follows an acute infectious pneumonia the exudate in the air vesicles becomes organized into fibrous tissue and a connective tissue change takes place in the alveolar walls as well.

Symptoms. Of these the most constant is cough which is much more distressing at some times than at others; it may be paroxysmal. With the cough there is muco-purulent expectoration; when bronchiectatic cavities are present considerable quantities of sputum may be raised from time to time, this manifestation occurring when the cavity is emptied; this sputum may be fœtid. Hæmoptysis may take place. Dyspnœa is a frequent symptom; it is seldom of very distressing character. The course of the disease is chronic and may be protracted for years, but the patient is seldom prevented from doing light work.

Physical Signs. Inspection reveals a retraction of the thorax upon the affected side and a restriction in its respiratory movement; the unaffected side is more prominent and of greater circumference than normal as a result of compensatory emphysema. The apical impulse of the heart may be displaced. Vocal fremitus is diminished if the pleura is thickened. Upon percussion there is dulness or a tympanitic note; over a bronchiectatic cavity the note is amphoric. The note over the unaffected side is hyper-resonant. Auscultation over lung that is solidified by fibrous change reveals a diminished respiratory murmur, broncho-vesicular or even bronchial breathing, or, if a cavity is present, amphoric breathing. The voice corresponds to the respiratory sounds. The hypertrophy of the right ventricle of the heart results in an accentuated second pulmonic sound; failure of this ventricle is evidenced by the appearance of cardiac murmurs.

The diagnosis is usually easy; fibroid phthisis may, however, be mistaken for interstitial pneumonia. Differentiation may be made upon the more frequent fever, signs of tuberculosis in the other lung and upon the presence of tubercle bacilli in the sputum in the former condition.

The prognosis is unfavorable as to recovery. The course of the disease is prolonged—ten years or even more. Death usually takes place from gradual failure of the right side of the heart, more rarely from hyaline degeneration of the viscera, or hæmoptysis.

Treatment consists in the employment of tonics, nourishing food and all measures calculated to improve the patient's general condition. Life in a warm dry climate may do much to increase the sufferer's comfort and to prolong his life. Respiratory exercises may be advised but should be carried on under the physician's supervision. The cough may be controlled by the means suggested in the section on the treatment of chronic bronchitis and

should the sputum become foul the treatment applicable to fœtid bronchitis is indicated. Hyoscyamus or belladonna may lessen the tendency to spasmodic cough.

EMBOLIC PNEUMONIA.

Hæmorrhagic Infarct of the Lung.

Ætiology. This condition is caused by the lodgment in one of the branches of the pulmonary artery of an embolus which has had its origin in or has reached the right heart from the systemic circulation. Large emboli may cause sudden death, smaller ones cause infarcts of varying size unless the site of lodgment is not in a terminal artery. In this case collateral circulation may be established.

Pathology. Pulmonary infarcts are conical in shape and correspond to that portion of the pulmonary area which is deprived of its blood supply by the plugging of its artery by the embolus. The base of the cone is toward the periphery of the lung and the infarct varies in size from that of a pea to that of an egg; when fresh it is red-brown in color and its pleural surface projects beyond the surrounding tissue. The pleura covering it becomes the seat of a deposit of fibrin. In consistency it is more or less solid owing to the transudation of blood which later undergoes an inflammatory change. This consists first of an emigration of leucocytes from the neighboring vessels, then disintegration and absorption of the red blood cells takes place causing the dark red or brownish color of the infarct to diminish. Finally the infarct becomes pale and the tissues which have been the seat of the transudation contract until little but a fibrous scar remains. The ultimate result is a grayish contracted spot in the lung. If there is a deposit of hæmatoidin crystals the resulting color is dark red. Larger infarcts may soften in part and disintegrate, the degenerated portion being absorbed or expectorated. In certain instances the scar in the lung may undergo cheesy degeneration and calcification.

Symptoms. Large emboli, as has been stated, may cause sudden death without symptoms. Smaller emboli are evidenced by increasing pain in the side and, if a portion of lung of considerable size is obstructed, there is dyspnœa. Cough with bloody expectoration may be present. The physical signs depend upon the size of the infarct. In those of small area only the signs of a localized pleurisy are obtainable. If the consolidation is of large extent there are dulness, exaggerated vocal fremitus, crepitant and subcrepitant râles, and bronchial voice and breathing.

The diagnosis. The symptoms in slight instances where the infarct is of small size may be insignificant. In more marked instances the sudden onset with pain in the lung, cough and dyspnœa, without rise of temperature,

especially if the patient is the subject of arterial disease, renders the condition one not easily to be mistaken.

The prognosis is good except when the embolus is very large; here death may take place without warning, a considerable portion of the lung being left without blood supply.

Treatment. The patient should be kept absolutely quiet in bed. The pain may be relieved by counter-irritation in the form of dry cups or a mild mustard paste; if this symptom is very severe morphine may be necessary. Otherwise the treatment is wholly symptomatic.

Septic Embolic Pneumonia.

Synonym. Metastatic Abscess of the Lung.

Ætiology. This condition is the result of the lodgment of a septic embolus in one of the vessels of the lung. Such infective emboli may become detached from a thrombus in a vessel at a localized infective process, such as a septic phlebitis, operation wound, compound fracture, septic puerperal uterus, etc. The embolus passes through the circulation into the right heart, thence it reaches the lung, through the vessels of which it is transmitted until it reaches one of insufficiently large calibre to permit its passage; here it lodges and, being loaded with infectious matter, causes the formation of an abscess.

Pathology. The early stage is evidenced by the appearances found in simple pulmonary infarct; the extravasated blood is, however, more plentiful. Marked inflammation soon arises, the tissues are infiltrated with leucocytes which rapidly degenerate into pus and the whole area of the infarct softens and becomes an abscess cavity, which if near the pleura may rupture into the cavity of this membrane resulting in pyo-pneumo-thorax, or, the inflammation spreading by extension, simply a pyo-thorax.

Symptoms. The patient usually is suffering from pyæmia (q.v.) before the lodgment of the embolus; this adds to the symptoms of the primary condition a sudden pulmonary pain and a chill followed by rise of temperature and diaphoresis.

Treatment. If possible the abscess should be opened surgically and drained; otherwise the treatment consists in the administration of stimulants and the employment of other means applicable in pyæmic conditions (see p. 122).

BERI-BERI.

Synonym. Kakké.

Definition. A multiple neuritis of specific origin occurring epidemically and endemically in tropical and sub-tropical countries and characterized by motor and sensory paralyses and a tendency to œdema.

Ætiology. This disease is most commonly observed in Malayan countries where it attacks chiefly the natives; Europeans are affected with comparative infrequency. It prevails extensively in China, Japan and the Philippines and from time to time appears in epidemics which may be attended by great mortality. In our own country instances are not infrequently observed in the various seaports and the disease has been met in insane asylums in Alabama and Arkansas, in Louisiana and among Chinese fishermen in Alaska. The chief predisposing cause seems to be the aggregation of a number of individuals in crowded quarters, barracks, jails, ships, etc., under unsanitary surroundings, in connection with an improper or insufficient diet. The disease is seldom seen at high altitudes and warmth and dampness are the most favorable meteorological conditions for its development. Males are more frequently affected because they are more frequently exposed and the majority of instances occur in adolescents and young adults.

The theories that the disease is caused by a diet of fish, of diseased rice, or by intestinal parasites are untenable but it is a fact that there has been a great diminution in beri-beri in the Japanese navy since a more general dietary has been allowed, which fact leads Takaki to believe that a regimen containing too much carbohydrate and too little proteid is a considerable factor in the production of the disease.

The germ theory of the affection has various arguments in its favor which are summed up by Hamilton Wright in the statement that beri-beri is due to a specific micro-organism entering by the mouth and developing and evolving a toxin, chiefly at the pyloric end of the stomach and in the duodenum, which is absorbed and acts upon the peripheral endings of the afferent and efferent neurons. He believes that the specific cause of the disease is given off in the fæces and is capable of producing the affection whenever conditions of weather, climate and mode of life are favorable. At such times the specific germ entering the body upon food or drink gives origin to the disease.

Pathology. The most constant and characteristic morbid changes are a degeneration of the terminal branches of the peripheral nerves, atrophy of the nerve cells of the heart and of the terminations of the pneumogastric nerve; later the trunk of this nerve, as well as those of the phrenic and splanchnics, is involved. There is degeneration of the heart muscle and of the voluntary muscles. Wright has found in acute instances congestion and petechial hæmorrhages in the pyloric end of the stomach and in the duodenum. He believes these to be the specific pathologic changes of beri-beri and that they are constant in instances terminating fatally within three weeks of the onset.

Symptoms. The incubation period is indefinite but is probably a number of months. Premonitory symptoms, such as anorexia, epigastric pain, respiratory oppression and slight fever, are common; chills and cerebral symptoms are more unusual.

Four clinical forms of the disease may be described.

a. The mild or incomplete form of which the chief manifestations are pain, weakness and numbness in the legs. There may be small and distinctly marked areas of anæsthesia; œdema of the legs may be present; palpitation and cardiac irritability are common. Muscular weakness and abdominal distress may occur. Such instances of the disease usually last only a short time but may recur during the next warm season or develop a sudden acute attack of cardiac weakness.

b. The dropsical or wet form resembles in its onset the preceding type, but œdema, beginning in the feet and legs and soon involving the whole body including the serous cavities, soon appears; the nerve symptoms are not particularly marked but cardiac disturbance, with dyspnœa and cyanosis is frequent and distressing.

c. The atrophic form is characterized by an increasing disability to walk, there are pains and contractions in the muscles of the legs; the paralysis extends to the body and sometimes to the arms; there are areas of hyperæsthesia and anæsthesia and there may be extensive atrophy of the muscles with wrist and foot drop; there is ultimate loss of both galvanic and faradic irritability. Cardiac symptoms are slight and may be absent.

d. The acute pernicious form. Here the symptoms of onset may be those of the mild type of the disease with suddenly developing manifestations of cardiac failure or the attack may be of the cardiac type from its inception. There is severe precordial pain with marked palpitation and dyspnœa; the patient gasps for breath, the face is anxious, the lips are flecked with blood-stained froth and death may occur within 24 hours, but usually life is prolonged for several weeks. Nausea and vomiting and diminished or suppressed urine are often seen when the disease is near its termination.

Fever is not usually noted after the onset of beri-beri unless caused by a complication or a recrudescence. Various cutaneous manifestations, such as mottling of the limbs and petechial and herpetic eruptions of the lips, are not infrequent. The urinary solids are usually diminished as also is the total quantity of this excretion. Albuminuria is not present.

The diagnosis *in the tropics* is easy and instances of neuritis, especially if associated with œdema, seen upon vessels coming from tropical ports should be viewed with suspicion. In doubtful instances irritability of the heart, if present, is strongly in favor of beri-beri.

The prognosis in the pernicious instances is most unfavorable; in other types the mortality varies in different epidemics from 2 or 3 to 40 percent. It must be remembered that patients apparently doing well may suddenly manifest most distressing heart symptoms. The sensory, motor and trophic disturbances are not permanent.

Treatment. Much may be done in the way of prevention. The diet

should be rich in fatty and nitrogenous food and if rice enters into the regimen it is preferably eaten unhusked. All over-crowding should be avoided.

The diet of a sufferer from the disease should be generous and regulated in accordance with the suggestions given above. If possible he should move to another climate, failing this he should be allowed to be up and in the open air as much as possible and his apartment should be one which may be thoroughly ventilated and to which the sun has free access. Massage and frictions should be prescribed and in the dropsical type of the disease this symptom may be relieved in the usual manner by means of diuretics and diaphoretics; the bowels should be opened by laxatives when necessary. Accumulations of fluid in the serous sacs may be drawn off by aspiration if indication exists. In the atrophic type faradism, galvanism, massage, hot and cold douches and frictions are useful. The cardiac attacks necessitate the administration of stimulants and here our chief dependence should be placed upon inhalations of amyl nitrite in emergencies and, if necessary, upon the continued use of erythrol tetranitrate. The action of this drug is quicker than that of glyceryl nitrate (nitroglycerine), to which it is analogous, and tolerance is not easily established; it is best given in pills of $\frac{1}{2}$ a grain (0.032), made up with kaolin, every 4 to 6 hours. Glyceryl nitrate is also useful as is digitalis in full doses. Venesection and the withdrawal of 12 to 14 ounces (350.0 to 420.0) of blood will often tide the patient through a cardiac paroxysm. The precordial pain and sense of oppression may be relieved by the hypodermatic use of morphine.

Tonics have a place in combating the tendency to wasting and anæmia, and arsenic, potassium iodide, iron, the glycerophosphates and strychnine are all useful. The hypodermatic injection of the following prescription has been suggested. Sodium cacodylate $1\frac{1}{2}$ parts, iron and ammonium citrate 3 parts, strychnine sulphate $\frac{8}{100}$ part and water 25 parts. The dose is $7\frac{1}{2}$ minims (0.5) at first, to be gradually increased to double this amount.

The treatment of the paralyses and of the muscular atrophy is identical with that of similar conditions occurring in an ordinary multiple neuritis. (See p. 789.)

MYCETOMA.

Synonyms. Madura Foot; Fungus Foot.

Definition. A disease of one or both feet due to mycotic infection and characterized by the appearance of black granules (the melanoid type) or yellow or white granules (the ochroid type).

Ætiology. The disease is caused by one of two varieties of streptothrix, the melanoid form by *strepothrix maduræ*, the ochroid form by *streptothrix*

mycetomæ. The organisms are nearly akin to the ray fungus. Madura foot is most common in India but is observed in other Asiatic countries, Europe and South America.

Symptoms. The nodules appear upon the sole and are at first hard and dense, later they break down and persistent sinuses result which discharge a foul pus which contains the black or yellow granules. The foot increases in size and ultimately all its tissues become involved, a soft oily mass resulting. The appearance of the affected extremity is typical, its surface being the seat of the discharging sinuses, its sole thickened and the toes extended. The ray fungus may cause a similar condition which may be differentiated from true madura foot by microscopic examination of the organisms contained in the discharge. In certain instances there may be metastases in other parts, the disease being transmitted by the lymphatics.

Treatment is wholly surgical. Excision of the diseased tissues may be effectual if done early enough; when the entire extremity is involved amputation becomes necessary.

FEBRICULA.

Synonyms. Ephemeral Fever; Irritative Fever.

Definition. A transient febrile disease due to any one of a number of irritant causes. The term ephemeral fever is applied to instances in which the rise of temperature lasts not over 24 hours. If the febrile movement persists for several days the condition may be denominated febricula.

Ætiology. The usual cause of these disturbances is a disorder of the digestive function, caused either by temporary derangement or by some irritant or toxic quality of the ingested food, by the changes in which ptomaines or toxalbumins are produced—intestinal auto-intoxication. The existence in the body of the specific ætiologic factor of one of the infectious diseases in insufficient amount to cause the typical manifestation of the affection may result in an abortive form of the infection which may disappear within a few days without having been evidenced by any characteristic symptom. Such conditions may be met in epidemics of scarlatina, enteric fever, etc., and other instances of idiopathic fever may be attributed to abortive types of pneumonia, rheumatism, tonsillitis, etc. The inhalation of sewer gas and of other foul odors has been held responsible for the occurrence of transitory fevers but it is possible that the condition has been mistakenly attributed to these causes.

Symptoms. These are usually sudden in onset but may be preceded by indefinite malaise. Rarely is there an initial chill. The rise in temperature is seldom over 103° F. (39.5° C.), the pulse is rapid, there are headache, bodily weakness, a coated tongue, loss of appetite, nausea and vomiting. There

may be either constipation or diarrhœa; the urine is dark, scanty, and often loaded with urates. Nervous symptoms, even delirium, are often observed in children. The temperature usually falls by crisis within a few days or a week.

The diagnosis must be made by exclusion. The absence of cutaneous manifestations or of local symptoms and the disappearance of the febrile movement within a few days are the most important points.

Treatment consists in clearing the alimentary tract by the administration of repeated small doses of calomel—$\frac{1}{4}$ of a grain (0.016) every $\frac{1}{2}$ hour to 6 doses—followed by a saline purge, the restriction of the diet to fluids, the induction of free action of the skin and kidneys by giving the sweet spirit of nitre and one of diuretic potassium salts. The patient should remain in bed during the febrile movement and tincture of aconite, 2 to 3 minims (0.13 to 0.2) given every 2 or 3 hours will tend to control this symptom and lessen the cardiac rapidity. Should there be marked evidence of intestinal putrefaction this may be combated by means of one of the bismuth salts, preferably the tetra-iodophenolphthaleinate.

PROTRACTED IDIOPATHIC CONTINUED FEVER.

From time to time fevers are observed which last from a few weeks to several months and present no symptoms which aid in ascertaining their specific cause. These may be atypical forms of the various infectious diseases, enteric fever, malta fever, etc., they may be due to pyogenic, or rarely to pneumococcic infection. Their chief symptoms are a moderate febrile movement lower in the morning, higher in the evening, prostration, impairment of digestive function, prostration and, it may be, manifestations referable to the nervous system. The spleen may be enlarged. These fevers are to be distinguished from enteric fever by the absence of the Widal reaction, from malaria by their resistance to quinine and the absence of the plasmodium, from tuberculosis by the absence of tubercle bacilli in the excretions and failure to respond to the tuberculin test. In the instances due to pyogenic infection the presence of an increased leucocytosis should aid in ascertaining the cause.

These patients usually recover, fatal instances developing in most subjects manifestations from which an absolute diagnosis of some infection can be made.

Treatment is eliminative and symptomatic; the bowels, skin and kidneys should be kept active, the diet should be of nourishing and easily digestible fluids and the various symptoms should be relieved as they appear. The patient's strength should be further maintained by the administration of tonics, particularly iron, quinine and strychnine, in small doses.

WEIL'S DISEASE.

Synonyms. Acute Febrile Jaundice; Infectious Jaundice; Epidemic Catarrhal Jaundice.

Definition. An acute disease, probably due to a specific infection and characterized by a remittent febrile movement, jaundice and pains in the muscles.

Ætiology. This affection usually attacks individuals in young or middle life and males rather than females. It is more common in the summer months and epidemics have been described as occurring in various parts of the world as India, Egypt and South Africa. It is rare in Europe and America although it has appeared in Greece and in North Carolina. Butchers seem particularly prone to the infection and it is also frequent in brewers and laboring men.

The specific cause is not known but, while the *bacillus proteus fluorescens* has been held responsible by certain observers, it is probable that the condition may be caused by a number of infectious agents.

Pathology. *Post mortem* examination reveals nothing characteristic, The intestinal mucosa may be congested and the liver and spleen hyperæmic; there may be acute degeneration (cloudy swelling) of the kidneys.

Symptoms. The onset of the disease is usually sudden, with a chill, followed by fever, headache, nausea and perhaps vomiting and general pains; the temperature is remittent and seldom rises above 104° F. (40° C.). Jaundice is an early symptom and is very variable in intensity; the stools may be clay colored. The liver and spleen may be enlarged and the former is often tender. The urine is dark, heavy, and contains albumin and casts, bile pigments and perhaps blood. In the severer infections nervous symptoms and even delirium may be present. The fever lasts from 8 days to 2 weeks and falls by lysis as a rule. Secondary fever may occur.

The diagnosis from bilious malarial fever may be made by the failure to find plasmodia in the blood; from acute catarrhal jaundice by the presence of fever and pains; from acute yellow atrophy of the liver and phosphorus poisoning by the favorable course and outcome.

The prognosis as to recovery is good as a rule but certain epidemics have been characterized by a considerable mortality.

Treatment is eliminative, supportive and symptomatic. For the first consideration small doses of calomel to free purgation followed by sodium phosphate once daily until convalescence is established, should be prescribed.

GLANDULAR FEVER.

Definition. An acute infectious disease of mild type, occurring chiefly in children and characterized by moderate pharyngeal congestion, fever

and enlargement of the cervical lymphatic glands, and, at times, those of the axillæ and inguinal region as well.

Ætiology. This affection is seldom seen after the age of 16 years and most instances are observed during the colder months. While probably due to a micro-organism which effects entry through the tonsils or pharynx, no specific cause for the disease has been isolated. Epidemics of glandular fever occur from time to time and the condition seems to be contagious since if often affects several children of the same family.

Pathology. The lymph glands are enlarged but if they suppurate this is probably the result of some secondary infection; there is said to be enlargement of the liver and spleen. Certain observers state that there is accompanying enlargement of the lymph nodes of the bronchi and mesentery but others refute this assertion.

Symptoms. After an incubation of from 5 to 8 days the disease is suddenly ushered in with stiffness in the neck, pain upon moving the head, loss of appetite, nausea and sometimes vomiting. There are pains in the head, abdomen and limbs. The temperature rises to 102° to 104° F. (38° to 40° C.), the tongue is coated and the cheeks are flushed. After 24 to 48 hours, palpation in the cervical region reveals enlargement and tenderness of the lymph glands. The throat and tonsils may be congested. The axillary and inguinal glands may be swollen. The evening temperature persists for from 2 days to a week when it falls to normal either gradually or by crisis; the symptoms soon ameliorate, but while the tenderness of the lymph glands disappears their enlargement may persist for several weeks. Recovery takes place almost without exception.

The diagnosis is simple, the various types of angina which are accompanied by glandular involvement being excluded by examination of the pharynx.

Treatment. At the onset the bowels should be freely moved, preferably by divided small doses of calomel. The fever and restlessness may be controlled by sponging with cool water or by small doses of acetphenetidine (phenacetine) or antipyrine. Rest in bed and a fluid diet should be enjoined during the febrile period. Cold or warm compresses may be applied to the tender glands; a compress wet in cold mercury bichloride solution has been recommended. The after treatment consists in the administration of tonics, especially the syrup of iron iodide and codliver oil.

MILIARY FEVER.

Synonym. Sweating Sickness.

Definition. An infectious disease characterized by fever, profuse sweating and an eruption of miliary vesicles.

Ætiology. Very little is known of the causation of this affection; it occurs in epidemics which are distinctly localized; often the inhabitants of a certain

town or district only are afflicted. It occurs most often in the spring and summer months and seems to attack women more frequently than men. It is a disease of adults. Unhealthy surroundings and lack of sanitation do not seem to be predisposing causes. At present the disease is seldom seen outside of France and Italy.

Pathology. No characteristic morbid changes have been described. The spleen may be enlarged; the blood is thin and dark.

Symptoms. Mild prodromata such as malaise, headache and anorexia may precede the invasion of the disease or the onset may take place abruptly, the patient, after retiring in apparently good health, waking in the night bathed in profuse perspiration. The sweating persists and the patient suffers from precordial oppression or pain, epigastric discomfort, headache, muscular cramps, prostration and the other usual symptoms of febrile disease. The temperature is elevated, the pulse accelerated, the respiration rapid. On the 3d or 4th day there is a tingling of the skin followed by an eruption of tiny miliary vesicles containing clear fluid which later may become turbid. The vesicles rapidly increase in size and appear first upon the neck and chest, spreading thence to the back and limbs. They break after 2 to 4 days and crusts form which later fall. With the incidence of the eruption the other symptoms abate. Rapid emaciation is characteristic.

The disease usually lasts about a week but is sometimes more protracted, the rash, at times, being delayed even for 2 weeks. Severe instances with hæmorrhages or pronounced cerebral symptoms have been observed. Relapses are not infrequent.

The diagnosis during an epidemic is easy. The profuse diaphoresis and the miliary eruption are characteristic.

The prognosis varies, the mortality in certain epidemics being high; the mean death-rate is stated to be from 8 to 9 percent.

Treatment. The channels of elimination should be kept freely open by means of laxatives and diuretic drinks. Quinine is said to be efficient in controlling the fever. The excessive sweating may be relieved, if necessary, by means of repeated hypodermatic injections of $\frac{1}{100}$ of a grain (0.0006) of atropine sulphate and the patient's comfort may be greatly augmented by frequent sponging with tepid water. The sense of cardiac and respiratory oppression, if distressing, may necessitate the employment of hypodermatic injections of morphine. The patient should be kept in bed during the acuity of the attack and the diet should consist of nourishing and easily digestible liquids.

JAPANESE RIVER FEVER.

Definition. Japanese river, or flood fever, is an acute infectious febrile disease which is observed in the workers who till the submerged banks of

certain Japanese rivers. Its causation is not definitely known but it seems to be borne by corn or hemp and at the point of its entrance into the body an ulcer is developed. The natives believe the disease to be the result of the bite of an insect.

Autopsy reveals no characteristic morbid changes; bronchial congestion, considerable enlargement of the spleen and of the mesenteric lymph nodes may be found.

Symptoms. The invasion of the disease is marked by the appearance of a round ulcer in the inguinal region, neck or axilla. This may be preceded by a prodromal period of several days during which the patient complains of weakness and chills. Following the initial lesion there are lymphangitis of the vessels draining the region of the eschar, conjunctivitis, bronchitis and a moderately high temperature. At the end of 6 days or a week a rash, consisting of red papules, breaks out upon the face, limbs and body; this persists for from a day or two to a week. The elevation of temperature continues for about 7 days more when the initial ulcer begins to heal, the symptoms abate and rapid defervescence takes place.

The prognosis varies; in certain epidemics the disease is very fatal.

Treatment consists in rendering the primary sore surgically clean and maintaining it in this condition, the application of cold to the lymphangitis and the employment of approved methods to relieve the other symptoms as they arise. The cautious use of quinine and sodium salicylate has been advised.

TICK FEVER.

Definition. This is a disease prevalent in certain parts of Africa, particularly in the Congo, in western Uganda and in the western portions of German East Africa.

The affection is due to the introduction into the body, by means of the bite of a certain variety of tick, the *ornithodorus moubata*, of a spirillum.

Observations upon this disease seem to show that the period intervening between the bite and the declaration of the disease is about one week. The invasion is abrupt but not marked by a distinct chill. There is prostration and the patient complains of headache and pain in the back and limbs. Food is distasteful and vomiting at the invasion is usual; moderate diarrhœa is common. The temperature is highest in the evening, an elevation of 104.5° F. (40.3° C.) not being uncommon. There are usually 3 to 4 attacks of fever which often terminate in sweating. Each attack lasts 3 or 4 days and the intervals from 5 to 19 days. Splenic enlargement may be observed and herpes, hiccough and epistaxis may occur. The principal characteristic of the affection seems to the prostration during the febrile attack and the quick return to comparative health with the subsidence of the tem-

perature. Under proper care the disease is seldom fatal and it would seem that one attack confers immunity.

The ticks which inoculate this disease into the human being infest the rest houses along the traveled roads and seem to be nocturnal in their habits.

The natives, when bitten, burn the ticks which they are able to capture and rub the ashes into the scarified skin at the site of the bite as a preventive of the fever.

TRYPANOSÓMIASIS.

Definition. This term is applied to the two conditions which may result from the occurrence within the human body of the *trypanosoma gambiense*. This trypanosome is an elongated flagellated body in length 2 to 4 times the diameter of a red blood cell; its body is fusiform, more or less curved and spirally twisted, and is elongated into a single flagellum at one end; an undulatory membrane extends throughout its length, at the base of which at the non-flagellate end is a small refractive body which is regarded as a centrosome. Near the middle of the body is an oval nucleus. It is analogous to several other trypanosomes, notably, *t. Brucei* and *t. Evansi* which are respectively parasites of horses and cattle and rats, and is transmitted to man by the bite of the human tsetse fly (*glossina papalis*), and perhaps by other means.

The conditions which result from inoculation with the *trypanosoma gambiense* are the so-called trypanosoma fever and sleeping-sickness or African lethargy. Both these affections occur at present only in the tropical regions although instances have been imported into other countries in the past. The blacks are chiefly affected, trypanosomiasis being extremely rare in the white colonists and missionaries; one or two cases of sleeping-sickness in Caucasians, have, however, been reported.

It is a recognized fact that the trypanosomes may be present in the blood without causing significant symptoms but under certain conditions definite manifestations occur.

Trypanosoma fever is characterized by a temperature of irregular type which may reach 104° F. (40° C.) and may be continuous or remittent. At intervals of from a few days to 2 or 3 weeks, periods, during which the temperature falls to normal, occur. Erythematous patches and scattered areas of œdema, the latter being particularly likely to involve the lower eyelids, may appear. The pulse-rate is rapid, the tongue is red, and there is progressive wasting and weakness. The superficial lymph glands are enlarged and examination of their fluid contents frequently reveals the presence of the trypanosome. Blood examination shows a moderate anæmia and an increase in the number of large mononuclear leucocytes as well as the presence of the trypanosome; the last may be absent at times for considerable periods.

Treatment. The patient should be kept in bed and so protected that he cannot be bitten by the flies which transmit the disease, in order that he may not prove a source of further infection. The diet should be nutritious and easily digestible. Arsenic seems to have some effect upon the parasites in the blood and may be administered hypodermatically. The best results are said to be obtained by iron arsenate and sodium cacodylate. Ehrlich and Shiga consider that a new aniline dye, trypan-red, is useful in this affection. It is said to have no direct effect upon the parasites within the body but is believed to possess the property of causing a reaction which results in their destruction. Malachite green may also be employed. The combination of these substances with arsenic has been suggested. Otherwise the treatment is wholly symptomatic.

Sleeping-sickness is a chronic condition resulting from the presence of the *trypanosoma gambiense* in the cerebrospinal fluid and is probably the terminal stage of trypanosoma fever. It occurs chiefly in negroes, less frequently is it seen in half-breeds.

Pathology. The disease is a meningo-encephalitis. After death the cerebrospinal fluid is found to contain red blood cells, leucocytes and trypanosomes. The capillaries of the brain and cord are surrounded by an infiltration of round cells. A mixed infection with streptococci may be observed late in the disease.

Symptoms. After a prolonged incubation period, perhaps of several years, the invasion takes place and may be characterized by various symptoms referable to the nervous system, such as convulsions and mental disturbances; there may be headache, dizziness and elevation of temperature. When the affection has fully developed the patient suffers from mental dulness and lethargy, from which he may be aroused to perform the bodily functions; speech is indistinct, the gait is uncertain and immediately upon being left to himself the patient falls into deep slumber from which it becomes progressively harder to arouse him. The body gradually wastes, bed sores make their appearance and death takes place either from secondary infection or in coma preceded by paralysis or convulsions.

Fluid drawn by lumbar puncture contains the trypanosome. The disease may last for several years and it is believed to be uniformly fatal in outcome.

Treatment is probably ineffectual but free purgation early in the infection and the administration of arsenic in large doses and of the other substances mentioned under the treatment of trypanosoma fever is advised.

KALA-AZAR.

Synonyms. Tropical Splenomegaly; Dum-dum Fever.

Definition. A distinct chronic infectious disease of tropical regions char-

acterized by persistent remittent fever, anæmia, emaciation, cutaneous pigmentation and hepatic and splenic enlargement.

Ætiology. The results of recent research lead us to believe that kala-azar is a disease distinct from every other and not, as has hitherto been supposed by certain observers, in any way connected with malaria. Its specific cause is probably the so-called Leishman-Donovan parasite. This organism is a form of trypanosome and is probably to be found in the blood, particularly that withdrawn by splenic puncture, at some period in every instance of the disease. It is a fusiform, circular or ovoid body with a spherical nucleus at one side; a number of these may be grouped in the form of a rosette.

Kala-azar occurs in low-lying, more or less water-logged districts of Asia and Egypt where the rainfall is heavy. Natives are most frequently attacked, the disease being rare in Europeans.

Symptoms. The onset of the affection is marked by chills, fever and gastric irritability. Splenic enlargement is constant, increase in the size of the liver is frequent. The temperature is of irregularly remittent type and may persist for months; periods when the fever is absent may occur from time to time. The patient becomes emaciated and anæmic, hæmorrhages into the skin and mucous membranes may take place and purpuric rashes and evanescent œdema may be observed. A grayish or blackish pigment may be deposited in the skin and there are muscular pains. The death rate is high, complications, particularly dysentery, being often responsible.

Treatment. Isolation and quarantine should be insisted upon for it has been shown that by these means the disease can be made to disappear. Quinine has no specific action upon the cause of the infection but may control the temperature to some extent. The treatment consists chiefly in the employment of hygienic and symptomatic measures and in combating the anæmia and bodily wasting by nourishing food and tonics. The removal of the patient from the infected district is advisable.

KUBISAGARI.

Definition. This is an endemic disease of northern Japan similar to the endemic paralytic vertigo of Switzerland, or Gerlier's disease. Its causation is unknown but it seems to occur in individuals who live in close association with their cattle. Males and females of all ages are attacked and the affection is most common during the warm season.

Symptoms. The course is protracted and is characterized by ptosis, double vision and impairment of sight and of the power of certain groups of muscles, especially those of the back of the neck, resulting in a falling forward of the head. Paralysis, partial or entire, of the masticatory, pharyngeal or leg muscles results, with interference with the performance of their functions.

In the intervals of the paroxysms the only persistent symptoms are the ptosis and falling forward of the head. The disease is never fatal.

Treatment. The frequency of the paroxysms may be somewhat diminished by the administration of the bromides, especially potassium bromide, and the continued exhibition of potassium iodide and arsenic is said to be of benefit.

LEPROSY.

Synonym. Elephantiasis Græcorum.

Definition. A chronic infectious disease occurring in two forms, (*a*) *tubercular leprosy*, which is characterized by the development of nodules in the skin and mucous membranes; and (*b*) *anæsthetic leprosy* in which there is a nodular infiltration of the nerve trunks. The two forms tend eventually to become combined.

Ætiology. Leprosy has been known since the time of Moses. At present it is endemic in certain parts of Asia, the Sandwich Islands, the West Indies, Greece and Turkey, and instances are not infrequently seen in Sweden, Norway, Iceland, Australia, South Africa, Mexico, Canada, and in the Southern and Northwestern United States.

The disease attacks both sexes and all ages and Hutchinson believes that a diet of fish is a factor in its causation, either inducing a susceptibility by lessening the bodily resistance or by carrying the contagium in its substance. A diet lacking in proteids seems to predispose to the disease.

The specific cause is the *bacillus lepræ* a micro-organism closely resembling the tubercle bacillus in certain particulars but easily differentiated by staining.

Mode of transmission. It is probable that very close association with patients is necessary to acquirement of the disease, for physicians and nurses who are in close contact with sufferers are seldom attacked. The possibility of the hereditary transmission of the affection is to be considered but it is without doubt of the very rarest occurrence. It is not certain that the disease may be contracted by direct inoculation but it is probable that this is the case.

The bacilli are given off in the discharges of suppurating lesions, in the saliva and nasal mucus when there are leprous manifestations in the throat or nose, and have been found in the urine and milk. They may be borne upon clothing and the disease has been transmitted by fomites. The most probable portal of entry for the contagium is through the respiratory tract, and certain observers believe that it may be contracted during coitus in the same fashion as syphilis.

Pathology. The nodes occurring on the mucous membrane and skin in the tubercular form of the disease are composed of small cells supported upon a framework of connective tissue; within and between these cells the lepra bacilli exist in large number. The nodules finally break down and form ulcers which may heal and cicatrize; in the ulcerative process fingers

and toes may be lost and the conjunctival and laryngeal mucous membranes may be affected.

In the anæsthetic type there is a peripheral neuritis resulting from the growth of the bacilli within the substance of the nerve fibres.

Symptoms. *a. Tubercular leprosy:* An intermittent febrile movement lasting for many months may precede the other symptoms; before the nodules develop there are often areas of erythematous redness upon the skin; their edges are well-defined and there may be cutaneous hyperæsthesia; pigment may be deposited in these spots, which may later disappear, without the development of nodules, leaving white anæsthetic areas (*lepra alba*). More commonly the tubercular nodules appear and persist, it may be, for years; ultimately they, for the most part, ulcerate, but some may disappear without undergoing this process. The occurrence of nodular growths, in the face, together with the cicatrized areas may give rise to the appearance termed the *facies leontina;* at times the nose and ears may ulcerate away and the breaking down of nodules in the cornea or larynx may cause blindness or loss of voice. Obstruction to respiration and even death may be caused by tubercles in the nose, pharynx, or larynx. Inhalation pneumonia is not infrequent.

b. Anæsthetic leprosy is evidenced by pains in the limbs, hyperæsthesia or numbness; the infiltrated nerves may be palpable under the skin and while at first tender, later become anæsthetic. Trophic disorders such as dryness or smoothness of the skin or the appearance of small bullæ may be noted. Areas of cutaneous anæsthesia appear and may be preceded by maculæ which later disappear. Vesicles form which burst leaving ulcers behind and the trophic disturbances may result in wasting and atrophy of the limbs and even the dropping off of fingers or toes. The disease may last for years without impairing the patient's functions but the increasing exhaustion finally overcomes him.

The diagnosis of an advanced instance of either type is very simple. In the earlier stages the areas of erythema with sensory disturbance are quite typical. In doubtful instances a section of the skin or of a tubercle should be examined for the presence of the *bacillus lepræ.*

The prognosis is not favorable as regards recovery, although this has occurred in the anæsthetic type, with, however, persistent trophic lesions. The course of the disease is chronic, lasting even 20 or 30 years; it is more rapid in the ulcerative variety. Death may take place from intercurrent disease or from the progressively increasing weakness.

Treatment. Isolation or segregation should be insisted upon in all instances. This is preferable to the legalized compromise which obtains in Norway; here the indigent lepers are cared for in an institution while those whose income is sufficient are permitted to remain at home under proper care

and restrictions. A leprous mother should not nurse her infant and it should associate with her as little as possible.

Treatment proper consists in attention to cleanliness, general hygiene and surroundings and the administration of plenty of nourishing food; certain observers consider that a diet too rich in carbohydrates and poor in proteids is a factor in the causation of the affection, consequently it would seem well to prescribe a regimen containing plenty of nitrogenous food. The internal administration of chaulmoogra oil often causes marked benefit. It may be given in beginning dose of 5 minims (0.33) morning and evening, the dose being increased daily by from 4 to 6 minims (0.24 to 0.40) until the patient is taking as much as 250 minims (16.0) daily in 3 or 4 doses. The drug may be given in milk, hot tea or in capsules and should be continued for 2 to 3 months. If gastric disturbance is caused the oil may be given *per rectum*, 2 drachms (8.0) in milk being the proper quantity, or it may be administered hypodermatically in daily dosage of from 1 to 2 drachms (4.0 to 8.0). An efficient substitute for chaulmoogra oil is sodium gynocardate which may be given in pill form; 20 to 80 grains (1.33 to 5.33) may be given daily. Gurjun oil is at present little used.

Encouraging results have been reported from the hypodermatic employment of mercury bichloride and sodium chloride, each $\frac{1}{4}$ grain (0.016) in 20 minims (1.33) of distilled water. This solution is injected deeply into the muscles twice a week. Ichthyol is recommended in tubercular leprosy and may be given in doses of $\frac{1}{2}$ a drachm to $2\frac{1}{2}$ drachms (2.0 to 10.0) daily. Large doses of potassium iodide may be given in the hope of causing the erythematous nodes to disappear. Other drugs from which favorable results have been obtained are sodium salicylate, potassium chlorate and sodium cacodylate. Calmette's antivenene, given hypodermatically in doses of 5 to 7 drachms (20.0 to 28.0), has been administered with benefit in certain patients. The injections are given every 2 days at first, then daily.

Locally inunctions of pyrogallic and chrysophanic acid and of 20 percent. salicylic acid have been recommended. The nodules before ulceration may be cauterized with the thermo- or galvano-cautery after which powders, such as thymol iodide or iodoform, may be applied. The latter should also be dusted upon ulcerations or a 1 to 20 phenol ointment, 5 percent. europhen (an organic iodine compound) in olive oil or 1 part of gurjun oil to 2 parts of lime water may be employed.

The frequent application to the nasal and buccal cavities of mild antiseptic solutions and of 10 to 20 percent. silver nitrate to ulcerations of mucous surfaces is to be advised.

The neuralgic pains may be controlled by the administration the coal tar analgesics, aconitine or gelsemine. Nerve stretching may be advisable in extreme instances.

Very recently excellent results have been reported as following the treatment of leprosy by means of the X-ray. At least one patient seems to have been cured since the presence of the bacilli, easily demonstrable before exposure to the rays, have disappeared as a result of their application, and improvement in a number of other patients has been noted; whether the results are permanent, time alone will tell. Wilkinson who makes the report believes that when a lesion is treated the organisms in that situation are killed and their bodies are absorbed, producing an immunity against the living organism. The part which presents the greatest involvement is selected and exposed to the ray usually for 10 minutes at a distance of from 7 to 10 inches. The effort is made to approach as near to burning the skin as possible without actually doing so. After two or three treatments a blushing of the skin is noticed and there is a sensation of itching. Of the three patients in which the result was considered to be successful in two the treatments were fourteen in number, in the third, fifty-two.

Recently rather remarkable results have been reported as due to the administration of a fluid extract of mangrove (*rhizophora mangle*). At first 2 drachms (8.0) are given morning and evening, later this dosage is increased to from 2 to 3 ounces (60.0 to 90.0) daily. Each night the patient is given a bath at 102° to 104° F. (38.9° to 40° C.) to which enough mangrove decoction has been added to redden the water. A light diet, chiefly of fruit and milk, is prescribed together with tonics such as coca and kola; no acids nor spices are allowed. The patient is advised to sleep in a cool room and to avoid the hot sun. Ulcers, if they appear, are dressed with 30 percent. of the fluid extract of the mangrove in water.

FRAMBŒSIA.

Synonym. Yaws.

Definition. A chronic contagious disease chiefly observed in the tropics and characterized by the development of granulation tissue in the true skin.

Ætiology. This affection is common in Africa, Southern Asia and the islands of the Pacific. In the West Indies, Central and South America it is less frequent. It is rarely met in the United States. Dark skinned races are more frequently attacked than whites and, while yaws may occur at any age, children are most frequently affected. While probably of bacterial origin, the specific micro-organism of the infection has not been isolated. The disease is transmissible by direct inoculation through an abrasion of the skin and also by food and eating and cooking utensils.

Symptoms. The period of incubation varies from 2 to 8 weeks. Prodromal symptoms such as malaise, anorexia, headache and pains in the muscles and joints, may be present, particularly in children, during this period. The invasion of the disease is marked by the appearance of the

primary sore which in experimental yaws appears at the site of inoculation. This is at first a small papule which within about seven days becomes a shallow ulcer which in turn soon heals leaving an indurated scar. The primary lesion may be wanting in certain instances. With the initial sore the secondary eruption may appear or, more usually, it is several weeks before its occurrence. It may be preceded by a pallor of the skin with a bran-like desquamation.

The secondary rash appears first on the face and soon spreads to other parts. It consists of small papules which are particularly numerous near the muco-cutaneous junctions. The papules enlarge forming tubercles under the skin as large as a good sized pea; at the top of these pustulation soon commences, and the skin breaking, a yellowish fluid is discharged which dries, forming a tough firm crust, under which the tissue is papillomatous, resembling a raspberry in appearance. From this raw surface there is an exudation of viscid yellowish pus. Pain is seldom present but there is usually an annoying pruritus. Successive crops of the lesions may appear and after several months they diminish in size and scab over, the crust ultimately falling and leaving behind a spot of increased pigmentation in whites and of skin lighter than the normal in dark races. In prolonged and untreated instances a third stage may occur, characterized by breaking down of the nodules, pains in the bones and joints, periostitis and bone caries.

The diagnosis. Yaws is to be distinguished from syphilis, to which it bears so close a resemblance that certain observers consider them the same or at least analogous diseases, by the lack of induration in the initial sore, of gland enlargement, of secondary involvement of the mucous membranes and of vascular thickening. Verruga bears a close similarity to yaws but is histologically a distinct disease.

The prognosis is usually good.

Treatment. Isolation of all patients should be practised, all abrasions of the skin should be properly treated and protected, and buildings in which patients afflicted with the disease have lived should be avoided. Constitutional treatment consists in the administration of potassium iodide; general tonic treatment, iron, arsenic, etc., are often necessary adjuvants. The external lesions should be kept clean by the application of antiseptics and, when advisable, should be protected by dressings. Sluggish ulcers should receive stimulation by means of silver nitrate and balsam of Peru and the chronic nodules may be treated surgically.

VERRUGA.

Synonyms. Peruvian Warts; Verruga Peruviana.

Definition. A chronic infectious disease characterized by a prodromal

febrile stage, rheumatic pains and the subsequent development of granulomatous wart-like excrescences upon the skin, mucous membranes and viscera.

Ætiology. This disease occurs only in certain parts of Peru upon the western incline of the Andes. It is not contagious but is inoculable and may appear in epidemics. The natives believe that it is contracted by drinking the water of certain springs. It attacks all ages and both sexes and seems to be intimately associated with a pernicious type of malaria known as "Oroya Fever." Its specific cause is unknown but a bacillus somewhat larger than the tubercle bacillus has been held responsible by Yzquierdo. One attack usually confers immunity.

Symptoms. After an incubation period of from 2 weeks to 40 days the invasion of the disease takes place; prodromata, such as malaise, and a tired sensation in the limbs, persist for a few days and are succeeded by an afternoon rise of temperature. The latter becomes gradually more marked and may be either remittent or intermittent in type. There are chills and pains in the joints of the extremities and in the spine; the pain is more severe at night and attacks one articulation after another. Muscular contraction involving the sterno-mastoid and calf muscles may be observed. The patient loses flesh and becomes anæmic, there is hepatic and splenic enlargement.

After about 3 weeks the eruption appears and with its incidence an amelioration of the other symptoms, including the fever, occurs. The rash shows itself first upon the face, the extremities and about the joints, the hairy parts are involved but rarely the trunk; it begins as small pinkish spots, soon becoming papular and dark red or bluish in color. The papules vary in number from only a few to several hundred and in size from that of a small pea to that of an orange; they are vascular and bleed easily. When occurring upon the internal organs they may cause difficulty in swallowing and bleeding from the œsophagus, stomach, bowel, bladder or uterus. The growths persist for several months and either dry into black spots which disappear leaving no trace, ulcerate or suppurate.

The prognosis is much more favorable in the natives than in whites, the mortality varying from about 10 percent. in the former to 70 percent. in the latter. An early incidence of the eruption augurs a favorable course and outcome, but delayed and atypical outbreaks signify a severe type of the disease.

Treatment. The removal of the patient to the lower levels near the sea is always to be advised and quinine should be administered on account of the possibility of a malarial element in the infection. Tonics and stimulants are often necessary and the ulcerous and suppurative excrescences should receive antiseptic treatment. In other regards the treatment is supportive and symptomatic.

MEASLES.

Synonyms. Rubeola; Morbilli.

Definition. An acute infectious febrile disease, often occurring in epidemics, and characterized by congestion of the upper air passages and a dusky red eruption of maculo-papular form.

Ætiology. The disease is commonly endemic, epidemics occurring in most thickly populated districts about every 2 years. It prevails chiefly during the cold months and appears usually in children, but adults may be attacked. Infants under 3 months seem to possess a certain degree of immunity. Measles is almost certain to be communicated to those not rendered immune by previous attacks and, when introduced into regions where the disease has previously been unknown, is extremely fatal.

The specific cause of measles is undoubtedly a micro-organism, but, while various bacteria have been found in the secretions of sufferers, none of these has been proven to be directly causative of the infection. The contagium is given off in the conjunctival, nasal and bronchial secretions and these are infective even before the stage of eruption. Dried particles of the secretions may collect upon clothing, furniture, etc., the latter thus becoming capable of transmitting the infection. The contagium is, however, short lived.

One attack usually, but not always, confers immunity. While mistaken diagnoses are responsible for many apparently repeated attacks, it is undoubtedly true that susceptible individuals may suffer from the infection more than once.

Pathology. The *post mortem* appearances in measles are in no way characteristic. The catarrhal condition of the conjunctival mucous membranes is not distinctive. Death is usually due to complications, especially bronchopneumonia, and the typical lesions ordinarily found in this condition are present. Lobar pneumonia with collapse of the lung may be found and swelling of the lymphatic tissues throughout the body, tonsils, lymph nodes, and intestinal follicles, may occur. There may be slight splenic enlargement. In instances of malignant or black measles hæmorrhages are present.

Symptoms. The incubation period is from 7 to 14 days, rarely a few days longer. Prodromata such as malaise, sneezing and feverishness may be noted at the end of this period. Leucocytosis may be present.

The period of invasion lasts 3 or 4 days, during which the symptoms of conjunctivitis and rhinitis are noted. The onset may be gradual or sudden and marked by chilly feelings—rarely a distinct chill—or a convulsion. The fever at first is not very high and may remit upon the 2d day. Following this the temperature rises to 104° to 105° F. (40° to 40.5° C.). Other symptoms of the onset are cough, nausea and vomiting. The pulse is rapid and full. As the fever falls the pulse returns to normal.

The symptoms continue for about 4 days and in severe infections cerebral manifestations may be present. On the 4th day the typical eruption appears. This consists of maculo-papules, at first rounded, rose-colored and slightly elevated, later tending to coalesce into crescentic shapes. The rash appears first upon the face and mucous membranes, then upon the body, the extremities becoming finally involved. At first the papules impart a shot-like feeling to the finger and may be mistaken for the eruption of smallpox. The rash disappears on pressure, is fully developed in from 2 to 4 days and then

FIG. 8.—Clinical chart of measles showing defervescence by lysis when the eruption is fully developed.

gradually fades. In from 10 to 14 days fine desquamation, lasting from a few days to several weeks, takes place. At the height of the eruption there may be enlargement of the glands of the neck.

A day or two before the eruption small red spots from the size of a pin head to that of a split pea appear on the lining of the cheeks and mouth. At the center of these is a bluish-white spot which may be made out with the aid of a strong light. The white spots may be removed by means of a forceps and, being examined, are shown to consist of epithelial cells in a state of fatty degeneration. These are known as Filatov's or Koplik's spots and are an important early diagnostic sign.

The symptoms of the disease continue until the eruption has reached its height. On the 5th or 6th day it begins to fade, the temperature begins to fall gradually and the symptoms become ameliorated.

Variations from the typical course may take place. *Morbilli sine morbillis*

is the term applied to the disease when the symptoms are manifested but no eruption appears. A mild type, in which all the symptoms are slight and recovery takes place within a few days, has been described. Malignant or black measles is a severe and fatal type, characterized by hæmorrhages into the skin and from the mucous membranes, here the prostration is marked and all the signs of a severe toxæmia are present.

Complications. It is these which render measles a disease to be dreaded. Broncho-pneumonia is the most common and may be diagnosticated by the persistence of the cough and high temperature and by the physical signs of small areas of pulmonary consolidation. Lobar pneumonia may also complicate the disease. Less frequent complications are otitis media, laryngitis, diphtheria, ulcerative or gangrenous stomatitis, keratitis and parotitis. Nephritis, endocarditis and joint inflammations and nervous complications, while fortunately rare, have been observed. Among these may be mentioned hemiplegia, paraplegia, meningitis, multiple neuritis and cerebral abscess.

Pulmonary tuberculosis may develop as a sequel of measles and, in patients of suspicious diathesis, when the cough is obstinate, this possibility should not be forgotten. Diphtheria is not an uncommon complication in institutions.

The diagnosis of measles during epidemics is not difficult. Early in the affection the appearance of the spots upon the buccal mucous membrane is an aid in differentiation. The early involvement of the nasal lining and the conjunctiva as against the sore throat and enlarged glands of scarlatina should aid in differentiation from the latter disease. Fever for 4 or 5 days, accompanied by catarrhal symptoms, buccal spots and the appearance at the end of this period of a maculo-papular rash, tending to become crescentic, should differentiate from chicken-pox and German measles.

The prognosis in uncomplicated instances which occur amid good surroundings is favorable, provided the patient's general condition is good. In epidemics under unsanitary conditions as in asylums, army camps, etc., the disease is likely to be attended by a high death rate.

Poorly nourished patients and those affected with previous chronic disease are very prone to complications, especially pneumonia, and in this event seldom recover.

Treatment. *Prophylaxis* consists in immediate isolation and the removal of other children from the house. The latter should be kept from association with other children for at least 2 weeks in order that the disease, if contracted, may develop.

Many parents encourage their children to expose themselves on the principle that every one must contract the disease and that it is less likely to prove serious in childhood than in adult life, but this is little less than criminal.

All discharges, dressings, clothing, the sick-room, etc., should be disinfected according to the usual methods. The contagium of measles being of feeble vitality the quarantine need be kept up not longer than 4 or 5 weeks.

Measles is a self-limited disease and unfortunately we have no means of aborting it or shortening its course. Its treatment, therefore, is symptomatic and supportive; much also can be done in the way of preventing the incidence of complications.

At the onset of the disease the patient should be put to bed in a darkened room and isolated. The apartment should be well ventilated and, while its temperature need not be high, the patient should be carefully protected from draughts. The bed covering need not be heavy but should be sufficient to keep the patient comfortable. The bowels should be opened at the invasion of the disease by means of fractional doses of calomel followed by a saline and they should be kept open throughout the disease by means of laxatives. The skin should be kept active and the kidneys mildly stimulated by the simpler alkaline diuretics or spiritus ætheris nitrosi. The conjunctivitis may be controlled by means of the application of cloths moistened in cold water or by dropping a few minims of saturated solution of boric acid into the eyes at intervals. The lids may be prevented sticking together by smearing their edges lightly with vaseline. Should the conjunctivitis become purulent a few drops of a 5 percent. solution of silver vitellin (argyrol) should be instilled at frequent intervals. The care of the nose and pharynx is most important since it is by extension from these parts that the middle-ear frequently becomes involved. The nasal cavity and the throat should be frequently sprayed with diluted liquor antisepticus (U. S. P.). Following the cleansing influence of these alkaline applications the inflammatory condition of the mucous membranes may be relieved by spraying with albolene, to an ounce (30.0) of which about 10 drops (0.66) of eucalyptol or thymol or both have been added. The itching and burning of the skin may be relieved by sponging with tepid water to which a little sodium carbonate has been added or by rubbing in vaseline or oleum theobromatis. The fever ordinarily needs no especial treatment; should it rise to 104° F. (40° C.) or over it may be controlled by sponging with cool water or by small doses of antipyrine or acetphenetidine. In the early stages this symptom may be relieved by small doses of tincture of aconite—3 to 5 drops (0.2 to 0.33)—every 2 or 3 hours. If this drug is given the pulse should be watched and the medication should be stopped at once if any sign of cardiac depression is noted. The cerebral symptoms may be relieved by cool sponging or cool packs and by the application of an ice cap to the head, but when the pulse is weak and the extremities are cold and cyanotic, warm baths with the addition of mustard are indicated. Stimulation may be necessary, especially if pneumonia is present as a complication and here

small doses of alcohol or strychnine should be employed. In collapse the hypodermatic administration of camphor in æther or oil is useful.

For the bronchitis simple cough mixtures containing expectorants such as ammonium chloride or ipecac in small doses, with the addition of codeine or heroine if the cough is distressing, should be prescribed. In order to prevent broncho-pneumonia it is necessary that the patient have a plentiful supply of fresh air and yet that all chances of exposure should be studiously avoided. A flannel jacket should be fitted to the chest, the skin of which should be daily rubbed with olive oil to which a little turpentine or camphor may be added if desired. The administration of guaiacol carbonate is advocated in the treatment of the catarrhal manifestations of measles as being preventive of respiratory complications.

The various complications should be treated as when occurring independently. In institutions the occurrence of diphtheria as a complication may be prevented by the administration of an immunizing dose of antitoxin to each instance. According to Holt this procedure has been carried out with excellent results.

In instances when the eruption is delayed the patient should be given a hot pack by means of a blanket wrung out in hot water. This should be wrapped about him and then covered by a rubber sheet. This procedure induces profuse perspiration and the appearance of the rash.

The diet during the febrile period should be entirely fluid, consisting of milk, soups and broth. When the fever has subsided a gradual return to an ordinary regimen may be allowed.

The patient should remain in bed for about a week after the temperature has reached normal and must not be allowed to use his eyes for about a month. While desquamation is taking place the skin should be kept soft by means of inunctions of oil or cocoa butter. For considerable time after convalescence has become established the patient should be kept from exposure to sudden changes of temperature; particularly is this necessary if there is persistence of the cough. Here the administration of codliver oil and creosote carbonate is indicated and a change of climate is to be advised, preferably to one of high altitude, slight humidity and mild temperature. In ordinary instances tonics should be administered during convalescence and the diet should be plentiful, nourishing and easily digestible.

RUBELLA.

Synonyms. Rötheln; German Measles; Roseola.

Definition. An acute infectious febrile disease of mild type accompanied by a maculo-papular eruption and enlargement of the cervical lymph nodes and at times by mild catarrhal symptoms.

Ætiology. That this disease is distinct from measles and scarlet fever has been definitely proven. It occurs chiefly in children, although it may be contracted by adults. It is very contagious, although rather less so than measles and appears both epidemically and sporadically. The infection is probably microbic in origin but as yet its specific cause has not been isolated. The contagium is transmitted by direct contact with the patient and by fomites and is probably active from the beginning of the disease until well into the convalescent period. One attack usually confers immunity.

Symptoms. The period of incubation is from 1 to 3 weeks, averaging about 10 days and while there are often no prodromata, for a period of 2 or 3 days before the appearance of the eruption the patient may complain of chilly sensations, general pains and malaise, sore throat and slight fever. Mild bronchitis, tonsillar and glandular swelling in the cervical region may be present. Slightly before or synchronous with the appearance of the rash, which may be the initial symptom, the temperature rises to 100° to 103° F. (37.8° to 39.4° C.). The *eruption* appears first upon the face and spreads thence to the neck, trunk and extremities. At times it is confined to one part while at others it involves the whole cutaneous surface including the palms, soles and buccal lining. The rash is papular, rose-colored and may become confluent, the papules fusing irregularly, while the surrounding skin may become hyperæmic. The papules vary in size but are smaller than those of measles and do not fuse in crescentic shapes. When the eruption involves the various parts of the body in succession it is seen in all stages at the same time. In other instances it may appear upon all parts simultaneously. It reaches its height within from 24 to 48 hours and lasts from 2 to 5 days as a rule, when it may terminate in slight desquamation, less marked, however, than that of measles.

Sore throat is almost always present and swelling of the cervical glands, and even of those of the axilla and groin may occur. Slight catarrhal symptoms referable to the mucous membranes of the eyes and nose are not infrequent.

The pulse is rapid in proportion to the elevation of the temperature; the latter falls with the fading of the rash and the other symptoms gradually ameliorate.

The course of the disease is from 3 to 7 or 8 days and convalescence is rapid. Relapses may occur but complications are seldom seen. Rarely a complicating bronchitis, pneumonia, or digestive disturbance may be observed.

The diagnosis in typical instances is not particularly difficult. In instances indistinctly characteristic the problem is less simple. Such may be differentiated from measles by the absence of buccal spots and marked catarrhal

symptoms, by the mildness of onset, lighter colored and more diffuse eruption; from scarlatina by general mildness of course, absence of severe throat involvement, atypical tongue and absence of general erythematous eruption.

The prognosis is generally most favorable, delicate children, those whose surroundings are unhealthful and those who are unfortunate enough to be subjected to complications may succumb to the disease.

Treatment. The patient should be strictly quarantined until the diagnosis has been absolutely assured. Confinement to bed should be enjoined and fluid diet is necessary as long as the temperature remains elevated. The bowels should be opened at the onset of the disease by means of fractional doses of calomel followed by a saline and regular daily movements should be secured by mild laxatives or simple enemata if necessary. The skin should be kept active and cleansed by means of a daily sponge bath; cool bathing may be resorted to if the temperature causes anxiety. The catarrhal symptoms should be treated just as in measles and if there is cutaneous irritation this may be relieved by gently inuncting carbolized vaseline or theobroma oil. The enlarged glands may be rubbed with a 5 percent. ichthyol or compound iodine ointment.

The complications are to be treated as when they occur independently and during convalescence the administration of tonics, such as iron, strychnine and codliver oil, may be advisable, especially in debilitated children.

SCARLATINA.

Synonym. Scarlet Fever.

Definition. An acute infectious fever characterized by a diffuse scarlet rash upon the skin and usually accompanied by pharyngeal inflammation.

Ætiology. The disease occurs endemically in nearly all parts of the world and amongst all races; the natives of East India and of Japan are said, however, to be to some extent immune to the infection. At intervals epidemics of varying intensity appear. The disease is most common during the autumn and winter months and it affects chiefly children under the age of 10 years. Certain individuals and some families seem to be insusceptible. Nursing infants seldom contract the disease; in pregnancy and after surgical operations individual susceptibility is increased.

An enormous amount of work has been done upon the bacteriology of scarlet fever but up to the present time the results have been inconclusive. In the majority of instances the *streptococcus pyogenes* is to be found in the inflammatory exudates of the disease but, while certain observers believe this to be the specific cause of the infection, it seems more probable that this bacterium is present as a result of mixed infection and that the true cause of scarlatina is another micro-organism. Mallory has found a parasite in the skin

which has also been demonstrated in the serum of blisters by Duval and which occurs in various forms, notably in the shape of a rosette, resembling the rosette stage in the reproductive cycle of the malarial parasite. Class, whose researches have been confirmed by others, has found in the blood, urine, scales of epidermis and in cultures from the throat a diplococcus which may have some influence in the causation of the infection.

With regard to the bacteriology of scarlatina it may be definitely stated that the streptococcus is an important influence in the ætiology of the septic manifestations of the disease.

The contagium is much more resistant than that of measles, much less diffusible and less prone to infect those exposed. The latter fact may be due either to a natural immunity enjoyed by certain individuals or to a peculiarity of the contagium.

Mode of transmission. The contagium is probably contained in the secretions of the throat, respiratory tract and ear and in the particles of skin exfoliated at the termination of the disease. The disease may be communicated by direct contact with a patient or by fomites, the infection being very resistant and remaining viable for long periods in clothing, bed linen, books, etc. While the disease may be carried by a third person, this mode of conveyance is rare. Air may carry the infection for short distances and it may also be transmitted by means of milk with which infected persons have come into contact.

The poison usually affects the throat primarily, having been taken in upon the inspired air. It may also enter by means of the digestive tract. The fact that infants have been born while manifesting the disease at all stages would show that the infection may be transmitted by means of the blood. One attack usually, but not always confers immunity.

Pathology. This disease presents no distinctive morbid changes. The eruption is ordinarily invisible *post mortem* unless it is hæmorrhagic in character. The throat exhibits the appearances of simple follicular or ulcerative tonsillar and peri-tonsillar inflammation with an accompanying lymphoid enlargement or even abscess formation in the neck in the more severe instances. The viscera, especially the kidneys, are the seat of an acute degeneration and may contain foci of necrosis. The pathology of the various complications does not materially differ from that of these conditions when they occur independently.

Symptoms. The incubation period varies from 1 to 14 days but is usually 2 to 4. The invasion takes place suddenly or after a short prodromal period, characterized by indefinite malaise. The initial symptom is usually emesis; chills or convulsions may occur. The temperature rises rapidly to 103° to 105° F. (39.5° to 40.5° C.), the pulse is proportionately rapid—110 to 130—the face is hot and flushed, the tongue dry and the throat sore.

The eruption appears from 12 to 36 hours after the onset of the disease. The whole skin is flushed and scattered over it are numerous tiny red points; these may occur in irregular patches or they may be widely disseminated. The rash appears first upon the neck and shoulders and extends rapidly; the skin of the whole body and of the limbs may be involved within 48 hours. When the eruption is at its height the skin becomes almost uniformly red and swollen, particularly upon protected parts. The redness disappears on pressure but returns instantly upon its removal. Upon the face the rash is least apparent and usually involves only the forehead and cheeks, the skin about the nose and mouth remaining pale. The eruption is present upon the pharynx. It remains at its height from 1 to 3 days and gradually fades as the temperature falls. Variations of the eruption are not infrequent. In the severe types of the infection it is darker in color and hæmorrhagic petechiæ may be present. Vesicles containing turbid fluid may appear (*scarlatina miliaris*). The skin is often rough to the touch and itching and burning may be present. The rash usually begins to fade about the 7th to the 10th day and desquamation, lasting several weeks, takes place. This exfoliation may be so slight as to be difficult of perception after a poorly marked rash or, following one of severe type, the skin of the fingers and toes may come away in the form of moulds and the bits of desquamated epidermis may be numerous and of considerable size.

The tongue is at first red at the tip and edge with a whitish coat in its center through which the enlarged papillæ protrude giving the so-called "strawberry" or "raspberry" appearance. As the disease continues the white coating is shed and the tongue is left red, rough and even more like the surface of a strawberry or raspberry than before.

The pharynx may be the seat of a mild inflammation, of a follicular tonsillitis or of a severe anginoid condition caused by infiltration, ulceration and even pseudo-membranous inflammation of the pharyngeal structures; lymphoid enlargement and involvement of the cervical tissues may be noted. There sometimes is numbness and formication of both hands (Myers's sign).

The initial fever varies from 103° to 106° F. (39.5° to 41.1° C.), or even higher and continues with slight morning remissions until the rash begins to fade when it falls by lysis. Hyperpyrexia may occur in severe infections. The pulse is rapid in proportion to the height of the temperature and the respirations are also accelerated. The spleen may be slightly enlarged. The urine is scanty, hyper-acid, high colored and often contains a trace of albumin and a few casts. This should cause no undue alarm as the urine is likely to become normal once more; it should, however, be examined daily since nephritis is an important and not infrequent complication. Leucocytosis may be present.

The duration of the febrile movement of an ordinary instance of scarlatina

is from 3 or 4 days to 2 weeks, depending upon the severity of the infection.

Irregular forms of the disease occur. These are of 3 chief classes:

1. *Anginose scarlatina* which is characterized by severe pharyngeal symptoms; the throat is markedly swollen and dysphagia is present, upon the tonsils there is a pseudo-membranous exudate which may result in abscess formation and ulceration. The inflammation may extend to the larynx, trachea, and bronchi, and is almost certain to reach the middle-ear by means of the Eustachian tube. The disease may terminate in death and sloughing of the tissues of the neck is not an unusual occurrence.

2. *Malignant scarlatina* is characterized by a severe toxæmia which may

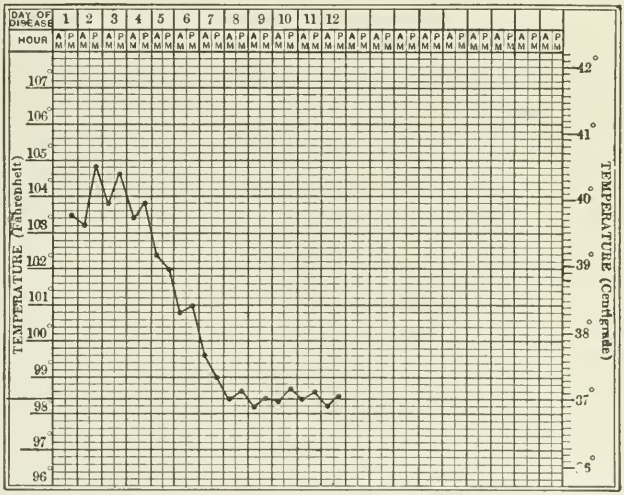

FIG. 9.—Clinical chart of scarlatina.

overwhelm the patient and result in death even before the diagnosis is made. Hyperpyrexia is present, the pulse is very rapid, soon becoming weak, the prostration is marked and the cerebral symptoms are profound. Death takes place from adynamia.

3. *Hæmorrhagic scarlatina* is typified by the appearance of extravasations of blood beneath the skin and mucous membranes resulting in epistaxis, hæmatemesis, intestinal hæmorrhage, hæmaturia, etc. This form of the disease is usually fatal.

Complications. Of these *nephritis* is the most important and perhaps the most frequent. It is of acute type and must not be confounded with the albuminuria which so often occurs when the fever is at its height. It is

usually evidenced by the appearance of albumin and casts in the urine but instances have been noted in which renal changes have been found *post mortem* when no symptoms suggesting nephritis had been present. The condition is probably the result of the toxic action of the poison of the infection and occurs in several forms: *a*, A mild type with slight œdema and albuminuria and a few casts; *b*, a more severe type, with more marked œdema, dark urine with more abundant albumin and casts and transudates into the serous cavities, resulting in death with uræmic symptoms, chronic nephritis or, as a rule, recovery; *c*, a hæmorrhagic type, with scanty urine containing blood, albumin and numerous casts. Anuria may occur, vomiting and convulsions are frequent; the outcome is usually rapidly fatal and due to uræmic poisoning.

Endocarditis is not rare. This may persist after recovery from the scarlatina or may occur in a malignant form which is usually fatal. *Myocarditis* and *pericarditis* are less frequent but are complications to be dreaded.

Pleurisy, *empyæma*, *bronchitis and broncho-pneumonia* are less common complications.

An *arthritis* may occur in one of two forms: an arthritis similar to that occurring in other infections such as enteric fever or gonorrhœa and involving several joints as a rule, or a suppurative inflammation affecting one or more articulations. The prognosis is good in either type.

Otitis is a serious and not uncommon complication and is the result of the extension of the throat inflammation through the Eustachian tube to the middle-ear. Perforation of the tympanic membrane is frequent and mastoiditis with all possible complications may follow. Impairment of hearing or complete deafness may result.

Adenitis accompanied by glandular enlargement in the cervical region is very common and may go on to abscess formation and necrosis in the deep tissues of the neck.

Complications referable to the nervous system are rare but sometimes occur. Of these the most important is chorea which may be associated with the arthritis and endocarditis. Hemiplegia, progressive paralysis and cerebral thrombosis have been observed.

The diagnosis of scarlet fever is usually not difficult in typical instances. the rash, the pharyngeal symptoms and the tongue being characteristic. Scarlatina may be differentiated from *measles* by its more abrupt invasion, the presence of throat symptoms, the absence of the buccal spots and catarrhal symptoms and the desquamation; from *rubella* by its more severe constitutional symptoms and characteristic tongue; from *diphtheria* by its eruption and by bacteriological examination, but it must not be forgotten that the two infections may be present simultaneously; from *drug eruptions* by the presence of constitutional symptoms and sore throat; and from *acute exfoliative dermatitis* by the presence of the characteristic tongue and throat symptoms. In der-

matitis the desquamation differs, the skin being thrown off in crusts and scales; a moist surface is frequently left.

The prognosis is variable. In some epidemics the mortality is high, but as a rule the death rate in this disease is not great. It is higher in infants and in institutions. The malignant and fulminating instances are fortunately not common for they are almost certainly fatal. Complications are usually responsible for death when this occurs in the ordinary type of the disease. Relapses in scarlatina are rarely observed.

Treatment. *Prophylaxis* is most important for by proper methods the disease may be to a great extent prevented. Isolation during the course of the disease and thorough disinfection of the sick-room and its contents are absolute essentials. The physician should always cover his ordinary clothing with a long gown while visiting the patient and upon leaving should disinfect his hands and his face and hair in so far as is possible. Only the persons immediately concerned in the care of the patient should be allowed in the sick-room, all the excreta should be rigidly disinfected and the skin, especially during desquamation, should receive inunctions or baths in an antiseptic solution to prevent dissemination of the exfoliated epidermis. The quarantine should be continued for from 6 to 8 weeks after the onset of the disease.

A careful system of school inspection will do much to prevent the spread of this infection.

The treatment of the disease itself consists in strict confinement to bed during the febrile period and for a week or ten days thereafter, the control of symptoms and in the prevention of complications. The mild types of the disease need little or no medication. The sick-room should be light, well-ventilated and kept at a uniform temperature of from 65° to 68° F. (18.5° to 20° C.). The itching and burning caused by the eruption may be relieved by inunctions of carbolized vaseline, 5 percent. ichthyol ointment in lanolin, or 5 percent. boric acid ointment in vaseline. Sponging with very weak (½ percent.) phenol solution as well as dusting with talcum powder are also useful. Inunctions of colloidal silver (unguentum Credé) may exert an effect upon the septic nature of the disease as well as a beneficent influence upon the skin. Inunctions are particularly indicated during desquamation to prevent the dissemination of the scales. Baths of warm soapsuds may also be given and, if the skin is irritated, bran baths may be employed.

The temperature in ordinary instances may be neglected but should it rise above 104° F. (40° C.) it may be reduced by the application of an ice coil over the heart, cool sponging or cool packs. Quinine has been advocated; the only effect which it can have in this disease is to temporarily lower the temperature. For the cerebral symptoms cool sponging, the ice cap and small doses of salipyrine, salophen, acetphenetidine or antipyrine may be employed. These drugs, while reducing the tendency to insomnia and restless-

ness, also have an antipyretic effect. A daily sponge bath with tepid water and soap should be given for the sake of comfort and cleanliness.

Stimulation in the milder forms of the infection is unnecessary but in severe instances of septic or anginose type with weak, rapid and irregular pulse it is indicated. Brandy or whiskey is usually preferable, the dose depending upon the condition in hand. Digitalis in the form of the tincture may be given when the pulse is rapid and of low tension, the dosage for a child 5 or 6 years old being 1 drop (0.065) every 5 or 6 hours. Strychnine in doses of from $\frac{1}{200}$ to $\frac{1}{100}$ of a grain (0.0003 to 0.0006) may be given alone or in connection with other stimulants.

Throughout the disease the bowels should be kept freely open, an initial course of fractional doses of calomel followed by a mild saline being indicated at the onset. As the disease progresses saline laxatives may be given from time to time or the high intestinal irrigation with hot water (112° F.—44.5° C.) may be employed. The latter is a most excellent stimulant and diuretic and an aid of considerable value in the elimination of the poison of the infection.

Pilocarpine has been recommended in the treatment of scarlatina; it is said to reduce the temperature, to improve the condition of the throat and to prevent glandular involvement. It should not be given with the coal tar antipyretics and, should idiosyncrasy to the drug be present, atropine will be found to be an effective antidote.

The simple form of pharyngitis needs no other treatment than a mild antiseptic mouth wash or throat spray of Dobell's solution or of diluted liquor antisepticus which should be applied every 4 hours. Nasal involvement should be controlled by syringing or spraying with similar agents. The severer throat inflammations should be carefully treated in order to prevent, if possible, aural complications. Here hot, or preferably cold, applications should be made to the throat externally and endeavors should be made to keep the throat itself as nearly clean as possible. Frequent irrigations of hot, mildly antiseptic solutions such as $\frac{1}{2}$ saturated solution of boric acid, 0.1 percent. iodine trichloride, 0.2 percent. salicylic acid, etc., are useful. The irrigation should be of considerable quantity and given while the child is lying with its head turned to one side and slightly lower than the res of the body. It may be given by means of a fountain or ordinary syringe to which a soft rubber catheter is attached. If the swelling is marked and there is tendency to œdema, sprays containing adrenalin chloride may be employed and steam inhalations impregnated with compound tincture of benzoin or eucalyptol may be prescribed. Insufflations of equal parts of sozoiodol and sublimed sulphur are recommended; 10 percent. phenol in glycerin may by injected into the seat of the inflammation in instances of gangrenous tonsillitis.

Slight enlargements of the cervical glands usually subside without treat-

ment but more marked glandular involvement necessitates the employment of continuous cold by means of the ice bag held in place by bandages. Inunctions of ointment of colloidal silver (unguentum Credé) are useful and a thin gauze compress impregnated with 10 percent. ichthyol ointment may be applied to the glands beneath the ice bag. The presence of pus demands immediate incision and drainage.

The prevention of complications is a most important part of the treatment of this disease. While at times these occur in spite of all attempts at prophylaxis, this fact should not deter the physician from employing every means in his power. In preventing the incidence of nephritis it is particularly necessary to watch the urine carefully, examining it at least once a day, to studiously guard the patient against exposure to draughts, to continue the fluid diet and the confinement to bed for at least a week after all febrile symptoms have disappeared and not to allow the patient to leave the sick-room too soon. It is far better to err upon the safe side in this regard than to permit the patient to go out too early. Recently the use of hexamethylene (urotropin) has been advocated as a prophylactic against scarlatinal nephritis and has seemed efficient in some instances while inert in others; it certainly can do no harm when given in proper dosage and carefully watched. The prophylactic use of digitalis has also been recommended and it would seem that the employment of high rectal irrigations of hot saline solution should be effective. The treatment of scarlatinal nephritis, when it occurs, is identical with that of acute nephritis when occurring from other causes.

The prevention of aural complications consists in the methodical and thorough treatment of the pharyngeal conditions as laid down above. The drum membranes should be inspected daily for any sign of bulging and, when necessary, immediate paracentesis should be done, the opening to be kept free as long as there is the slightest tendency to discharge. The discharging ear should be irrigated with warm boric acid solution in considerable quantity every 4 hours. The practitioner should never hesitate to summon the otologist in consultation when the condition is in the least doubtful, for upon proper management of the aural complications of scarlatina the patient's hearing may depend. Mastoiditis, internal ear involvement, sinus thrombosis, etc., are conditions for the otologist alone and their discussion is beyond the scope of this work.

The treatment of the joint complications consists in immobilization and the application of hot moist compresses. While by no means always satisfactory in its results, the administration of the salicylates should be undertaken. These may be given in appropriate dosage by mouth, or salicylic acid may be given by inunctions as suggested under the treatment of acute articular rheumatism. Acetyl-salicylic acid (aspirin), adult dose from gr. x to xv—0.66 to 1.0, may be employed. The chronic joint complications neces-

sitate the internal and external exhibition of the preparations of iodine. The presence of pus in a joint is an indication for immediate surgical interference.

The treatment of the other complications is identical with that to be instituted when these occur independently.

Advances have been made during recent years in the serum treatment of scarlatina by means of antistreptococcus serum; this serum is used rather to combat the complications which are due to streptococcus infection than with the hope of influencing the disease itself. The results, particularly those attained with Moser's serum, would seem to justify the employment of this means of treatment. It is particularly indicated in the severer and complicated types of the infection. The serum is given in considerable amounts and acts best when administered in the early stages. The initial dose may be about 5 drachms (20.0) and a total quantity of 5½ ounces (180.0) has been given. The disadvantages of the treatment are its costliness and the large amount of serum necessary.

Von Leyden's so-called convalescent-serum is reported to achieve good results.

The treatment of convalescence consists in the employment of tonics and careful watching of the urine which should be examined at intervals for a considerable period. Persistent nasal and throat symptoms necessitate the employment of antiseptic sprays.

The diet of the disease should be wholly of milk—plain or peptonized—throughout the febrile movement and, as a preventive of nephritis, for a week or ten days after the normal temperature has been reached. After this time an ordinary regimen may be gradually and carefully resumed.

FOURTH DISEASE.

Synonym. Dukes's Disease.

This affection is considered by Dukes to be an independent disease of mild character which simulates mild scarlatina, but differs from it in that its incubation period is much longer, being from 9 to 21 days, and in its lack of prodromal symptoms. The eruption resembles that of scarlet fever except that it appears first upon the face; it is usually followed by profuse desquamation.

Many observers doubt the existence of this disease as a separate entity, and it is certain that, before its identity can be clearly established, further study must be made of rubella. It has been suggested that this affection may be the result of a simultaneous infection with scarlatina and rubella.

Its treatment is entirely symptomatic and to be based upon that of the other infectious exanthemata.

VARICELLA.

Synonym. Chicken-pox.

Definition. An acute infectious febrile disease of mild type characterized by a vesicular eruption and usually seen in children.

Ætiology. The disease occurs sporadically but from time to time epidemics are observed. It is essentially a disease of children but adults who are not immune through an attack in childhood are quite likely to contract the infection. The affection is met in all climates and at all seasons and, while its specific cause has not yet been isolated, it is presumably a micro-organism, probably a protozoön. The contagium is found in the contents of the vesicles and the disease may be reproduced by inoculation with this. The disease is markedly contagious and may be transmitted by direct contact and possibly through a third person.

Symptoms. The incubation period is from 10 to 16 days and the eruption may be the first noticed symptom. In other instances there may be mild prodromata such as irritability, malaise and slight fever. The invasion may be marked by a slight chill followed by a rise of temperature to 101° to 103° F. (38.5° to 39.5° C.), vomiting, headache and perhaps general pains. The *eruption* appears, without other symptoms or within 24 hours of the invasion, first upon the upper part of the trunk, although it is first observed upon the face; often here the rash is usually scanty but the scalp is always involved. It occurs first in the form of small reddish points which quickly become rounded rose-colored macules. These become successively papules and vesicles within a few hours. These last vary from $\frac{1}{16}$ to $\frac{1}{2}$ an inch in diameter and later contain turbid fluid. Usually they are not umbilicated but at times this manifestation may be observed. In about 48 hours from their original appearance the spots have become pustules which upon being pricked collapse entirely, which is not the case with the pustules of smallpox. The rash lasts from 2 to 5 days when the pustules begin to dry, a brownish crust resulting, which soon falls leaving no scar; in certain instances a depression is left which, however, is seldom permanent. Successive crops of the eruption appear and the rash may be seen in all stages at the same time. If the vesicles are scratched or irritated small cicatrices may remain. The rash is also seen upon the lining of the mouth and pharynx and perhaps on that of the larynx. A scarlatiniform blush may precede its appearance. The eruption of varicella is always discrete and in mild infections there may be not more than 10 to 20 vesicles upon the whole body.

The temperature falls by lysis as the rash fades and, as this occurs, the other symptoms, if any have been present, disappear. The disease in children previously healthy is very mild but may be more severe in those less fortunate. In the latter, complications, such as nephritis and paralyses, have been observed.

A hæmorrhagic form of the disease with extravasations of blood into the eruption and from the mucous membranes has been described and gangrene of the skin about the pocks and of the scrotum has been noted in strumous children. Erysipelas and adenitis are possible complications.

The diagnosis is not difficult. The lack of constitutional symptoms, the occurrence of the eruption in all stages at one time, the absence of umbilication of the vesicles and of a surrounding areola are characteristic. There is no shotty feel under the skin as in smallpox. In infants the differential diagnosis between severe types of variola and mild cases of varioloid may present difficulties.

The prognosis is uniformly good, although in institutions and unsanitary districts the disease is prone to assume a severe type, and complications may occur which are likely to render the recovery of the patient somewhat uncertain. Immunity is usually, but not invariably, conferred by an attack.

Treatment. *Prophylaxis* consists in isolating the patient if the disease occurs in institutions or other places where many children are gathered. In private, quarantine may not be necessary unless the other children in the family are unhealthy or delicate. Quarantine, when instituted, should be continued until the last crust has fallen, the patient may then be released and his apartment disinfected; cleaning and thorough airing will usually be found sufficient.

The treatment of this disease is simple and consists chiefly in relieving the symptoms. The fever is seldom of a height to cause alarm and may be easily controlled, if necessary, by means of cool sponge baths. The headache may be alleviated by means of cold compresses. The bowels should be kept open and the skin and kidneys active. Cooling drinks may be grateful to the patient. If the eruption upon the buccal lining is painful this symptom may be relieved by rinsing the mouth with a 2 percent. to 4 percent. cocaine solution. The mouth should be kept clean by means of mild antiseptic washes; catarrhal conditions of the upper air passages and glandular involvement, which may be observed in strumous children, may be combated by the means suggested under the treatment of scarlatina. The itching of the skin may be, to some extent, prevented by a wash of very weak phenol solution, by applications of carbolized vaseline, 10 percent. boric acid ointment in lanolin or vaseline or a 3 percent. ichthyol ointment. To prevent scratching in infants it may be necessary to tie up the patient's hands in cotton wrapped about with gauze. It is important that the urine should be examined at intervals during and succeeding the disease.

It is best to keep the patient in bed during the febrile movement and the diet should consist of fluids. Ordinary diet may be gradually resumed after the temperature has reached normal.

SMALLPOX.

Synonym. Variola.

Definition. An acute infectious disease characterized by an eruption which appears first in the form of macules, which become successively papules, vesicles and pustules, upon the last of which crusts form which finally fall and leave permanent cicatrices.

Ætiology. This disease has existed in various parts of the earth since a very remote period. It invaded England in the 13th century and later was brought to America. Before the introduction of vaccination it was a common and very fatal disease, epidemics being by no means infrequent. Smallpox is very contagious, almost all unvaccinated persons who are exposed contracting the disease; instances of natural immunity have, however, been observed. A single attack usually confers immunity, but instances in which 2 to 3 undoubted attacks have been experienced have been reported.

The disease occurs in individuals of all ages and is especially fatal in children. Pregnancy predisposes to the infection and infants exhibiting an active eruption or the pock marks have been born of mothers who have contracted the disease during this period. Such instances are rare and a child born while the mother is suffering from the infection rarely contracts it if immediately vaccinated.

Males and females are equally susceptible but smallpox is more virulent in dark skinned races and is rapidly disseminated and very fatal amongst aboriginal tribes.

The disease is contagious throughout its whole course after the appearance of the eruption and a few moments of association with a sufferer are a sufficiently long time to contract the infection. The contagium may be carried to great distances on clothing, in bedding, etc., and the pulverized dry crusts retain their infectivity for several years. The contagium exists in the blood, secretions, the contents of the vesicles and pustules, in the dried crusts and probably in the excretions. Inoculation from the blood, the contents of the vesicles and pustules and from the scabs is possible but the chief mode of transmission is probably by means of the pulverized crusts which are taken in upon the inspired air. The poison of the disease may be transmitted by a third person and upon the air to an unknown distance.

The severest type of the disease may be contracted from a very mild instance.

The specific cause of smallpox is probably a micro-organism and much research has been conducted in the hope of isolating it. A bacterium has been found both in the contents of the pustules of smallpox and in the lymph of cow pox which may prove to be the cause of the disease, and protozoa have been described which exist in the epithelial cells of the cutaneous lesions.

Pathology. In addition to the typical eruption and its various modifica-

tions certain other morbid changes are found. The pustule has its origin in the *rete mucosum* just beneath the *cutis vera*. The pus focus is surrounded by a reticulum infiltrated with serum, leucocytes and fibrin. The central area of necrosis finally dries and forms a crust which falls, leaving no scar if the process extends no deeper. If the papillæ of the true skin are involved in the necrotic process and are destroyed, the loss of tissue results in a permanent cicatrix.

The eruption may occur upon the mucous membranes of the mouth, pharynx and œsophagus, the agminated glands of the intestine may be swollen and a few pustules may appear in the rectum. They also have been observed upon the conjunctiva and upon the mucous membranes of the nose and larynx. The lesions, when occurring in the trachea and bronchi, take the form of ulcerous erosions rather than true pustules. In the hæmorrhagic type of the disease there may be extravasations of blood beneath the skin and mucous membranes as well as into the viscera, muscles, marrow and other tissues.

Laryngeal œdema, perichondritis and chondritis, bronchitis and pneumonia may be observed as associated lesions and myocardial degeneration may take place. Peri- and endocarditis are seldom seen but splenic enlargement is common and the liver and kidneys are the seat of an acute degeneration (cloudy swelling). True nephritis is rare but may occur during convalescence.

In the hæmorrhagic type of smallpox the spleen is likely to be hard and dense and the liver of similar consistency or the seat of fatty degeneration.

Symptoms. The disease occurs in three types:

a. Variola vera of which 2 forms are described. 1. Discrete. 2. Confluent.

b. Variola hæmorrhagica of which 2 varieties have been observed. 1. Purpura variolosa or black smallpox. 2. Variola hæmorrhagica pustulosa or pustular hæmorrhagic smallpox.

c. Varioloid or smallpox as modified by vaccination.

a. *Variola vera, discrete form.* The period of incubation is from 7 to 15 days, usually 12. During this period there are rarely any prodromata, but at its end the invasion of the disease occurs suddenly with one or more chills. In children a convulsion is a frequent initial symptom. There are headache, backache, (which is characteristically intense) and general pains with nausea and vomiting and prostration. The temperature rises rapidly to 103° to 104 ° F. (39.4° to 40° C.) on the first day, the pulse is rapid and tense and nervous symptoms may be manifested; even delirium may be present in severe infections. The skin is usually hot and dry but in certain instances marked sweating may occur. The severity of the initial symptoms is no indication of the type of the disease.

About the 2d day the initial rash appears. It may be either diffuse and scarlatiniform or macular; while these eruptions may be general they usually occur only upon the lower abdomen, the sides of the chest, in the axillary region and upon the inner aspects of the thighs. Hæmorrhagic petechiæ may accompany them. The scarlatinal type is the more frequent. Initial eruptions are by no means the rule, since they appear in only from 10 to 16 percent. of patients.

About the 4th day the characteristic eruption of the disease appears, first upon the forehead along the hair line or upon the ventral surface of the wrists, whence it spreads downward over the trunk and limbs becoming general

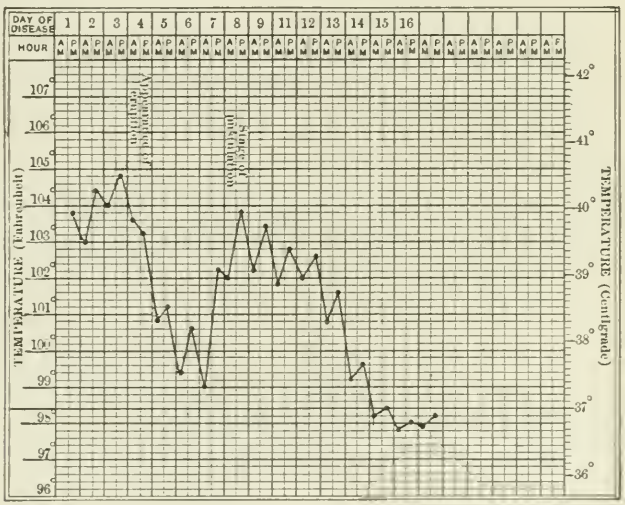

FIG. 10.—Clinical chart of smallpox showing fall in temperature upon the appearance of the eruption and its rise upon the incidence of the stage of pustulation.

usually within 24 hours. At first it is in the form of round pale, reddish macules which later become darker and slightly elevated. By the second day the papules have become firm and impart a feeling to the examining finger as of shot under the skin. By the 5th or 6th day the papules become vesicles containing clear or slightly turbid serum and umbilication is present which is a characteristic of the eruption of smallpox; by the 8th day the vesicles become pustules, the umbilication disappears and the skin and mucous membranes become tense, swollen, inflamed and painful. After the rash has persisted for from 10 to 12 days the pustules dry and crusts form which finally fall leaving no scars unless the deeper layers of the skin have been affected. In the latter event pit-like cicatrices of varying size

and depth persist. The rash appears upon the mucous membranes as well as upon the skin.

In true smallpox there is a distinct leucocytosis. At the end of the first week a count will reveal an increase to 12,000 or 15,000, later this may fall but at the end of the second week there is a second augmentation.

The temperature, upon the appearance of the eruption, falls, sometimes nearly to normal, but when the fluid in the vesicles becomes converted into pus the fever (secondary fever) recurs and with it the usual symptoms which accompany an abnormally high temperature appear. Not unusual symptoms of the disease are sore throat and hoarseness, due to the eruption upon the pharynx and larynx, vomiting and diarrhœa. Splenic enlargement is frequent and albuminuria may be present. As the rash drys and the crusts fall the temperature drops and all the other symptoms abate. The disease is said to possess a characteristic odor.

In the *confluent type* of smallpox the pustules are so closely situated that they coalesce. This manifestation is particularly likely to be present upon the face. In marked instances of this type, the skin of the face and limbs is thoroughly infiltrated with pus, the temperature is high (105° F— 40.5° C., or more) and cerebral symptoms as well as other signs of a severe infection are observed. Salivation may be present and there is enlargement of the superficial lymph glands. The appearance of a patient affected with confluent variola is most revolting. In the marked infections, from the 10th to the 12th day the patient becomes progressively weaker, the cerebral symptoms increase in severity and death may take place. In patients who recover the secondary fever is prolonged, depending upon the extent of the pustulation, lasting from 3 to 4 weeks. At the end of this period the pus dries and the crusts form. These, after adhering for a considerably longer period than those of discrete variola, fall.

b. Variola hæmorrhagica. The purpuric form of hæmorrhagic smallpox is characterized by the early appearance of a hæmorrhagic rash and of hæmorrhages from the mucous membranes. The condition is a very fatal one and the patient may die even before the appearance of the papules. Hæmaturia is common and hæmatemesis, hæmoptysis and corneal and intestinal hæmorrhages may occur. The skin may be purplish and the patient's appearance is most horrible. The temperature may not be greatly elevated, but the pulse is rapid and small, while the respirations are accelerated out of proportion to the height of the temperature.

In *variola hæmorrhagica pustulosa* the hæmorrhages do not appear until the stage of vesiculation or of pustulation is reached. Then there are extravasations of blood into the areolæ of the pocks and later their contents becomes bloody. Hæmorrhages from the mucous membranes also occur. While this type of variola is very fatal, recoveries sometimes take place.

These malignant forms of the disease are much more prone to occur in the unvaccinated.

c. Varioloid, or smallpox modified by vaccination or a previous attack from the disease, is usually much milder than the unmodified disease, although the initial pains may be severe. All the symptoms are less marked and the eruption is less diffuse. Secondary fever is slight or absent, the initial fever dropping and the symptoms clearing with the appearance of the eruption which matures rapidly. Permanent cicatrices are uncommon. This form of the infection, in rare instances, may be severe and even fatal. There is usually a direct ratio between the length of time intervening between vaccination and the attack and the severity of the latter.

Unusual types of variola sometimes are observed. *Variola sine variolis* or *sine eruptione* has been described and a form of the disease known as horn-wart or stone-pox, in which the papules dry before the vesicular stage, has been noted. Another abortive form is crystalline-pox in which the vesicular fluid remains permanently serous.

Complications. Those referable to the respiratory system are œdema of the glottis, inflammations of the laryngeal cartilages, pleurisy and broncho- or lobar pneumonia. Vomiting, diarrhœa—particularly in children—and parotitis may occur. Circulatory complications are rare; myocarditis with inflammation of the coronary vessels has been observed, but pericarditis and true endocarditis are very seldom met, although during the attack of the disease an apical systolic murmur may be heard. Albuminuria is common but true nephritis is rare. Orchitis and ovaritis have been described.

Cerebral complications, such as persistent delirium or coma, occur during the acuity of the infection and post-febrile insanity and neuritis have been reported. Joint inflammations may complicate convalescence and skin manifestations, such as painful acne, furunculosis and localized gangrene, are among the most important sequelæ.

Formerly the neglect of the eyes was responsible for various ophthalmic complications but attention to the cleanliness of these organs has now rendered these less common. Otitis from extension of the pharyngeal inflammation may occur.

The diagnosis is simple after the appearance of the characteristic eruption and in the earlier stages the severe pain in the back, the shot-like feel of the undeveloped eruption and its appearance upon the forehead about the hair-line are diagnostic points.

The catarrhal symptoms of measles and buccal spots are absent which aids one in differentiating the measles-like initial rash, and the scarlatinal form of initial eruption is less persistent than that of scarlet fever. In chicken-pox the rash is present in all stages at the same time and is very rarely umbilicated.

The differential diagnosis of the hæmorrhagic type from epidemic cerebro-

spinal meningitis offers difficulties. The only safe method is to isolate all suspicious patients until the diagnosis is confirmed.

The prognosis varies in different epidemics but at best smallpox is a disease to be dreaded, particularly in children. Hæmorrhagic forms are generally fatal. Pregnant women are likely to abort and frequently die. Pharyngeal, laryngeal and pulmonary complications render the infection especially serious.

Prophylaxis. The most strict isolation is absolutely imperative and, if possible, the patient should be removed to a hospital for contagious diseases. The room selected should be divested of all carpets, pictures and hangings, and all superfluous furniture should be removed. Before the door a sheet kept constantly moistened with 1 to 20 phenol solution should be suspended. Thorough ventilation is an absolute necessity. The nurse and physician should wear, while in the sick-room, a gown covering all the other apparel and a cap which are to be removed upon leaving the patient. None but the attendants should be allowed to visit the patient. All bed linen and clothing should be immersed in 1 to 1,000 mercury bichloride or 3 percent. phenol solution immediately upon removal and allowed to stand at least two hours before being sent to the laundry. All dressings, crusts from the eruption and sweepings must be immediately burned and the patient should be supplied with separate utensils and dishes.

After death the body should be sponged with strong phenol or mercury bichloride solution, the mouth, nostrils and anus having been plugged with pledgets of cotton moistened with either of these, it should then be wrapped in a sheet saturated with a disinfectant, placed in a metallic or air-tight coffin and buried as soon as possible. The disposal of such bodies by cremation is always to be preferred when practicable.

In the event of recovery the patient, before leaving the sick-room, should receive a thorough bath and shampoo with soap and hot water and then be sponged off with a 1 to 3,000 solution of mercury bichloride or immersed in a 1 to 5,000 bichloride solution bath. He should then be dressed in a clean night dress and removed to another apartment where he may put on other clothing. The quarantine should be insisted upon until the skin is clean and smooth and no trace of the crusts remains.

Room disinfection. The disinfection of the sick-room and its contents depends upon the means at hand. If a steam disinfecting plant is conveniently situated the bed, bedding and other fabrics should be made into bundles, wrapped in clean sheets and removed for steam disinfection. By care in transportation such packages may be transferred with little danger. The bedstead, furniture and wood work must be carefully washed with a soft cloth wet with 1 to 1,000 mercury bichloride or 3 percent. solution of phenol. All cracks and crevices should receive studious attention. The removal of superfluous objects greatly simplifies the disinfecting process. The walls,

if painted, should be treated in the same manner as the wood work; if papered they should be thoroughly rubbed with pieces of bread, then, if practicable, the old paper should be removed and burned and the walls re-papered. After attention to these details all the windows and the doors, with one exception, should be closed and sealed by pasting strips of paper with common flour paste over all the cracks. The sealing process is important, for upon the tightness of the room depends, in great measure, the efficacy of the disinfection. If the cracks allow the escape of the disinfecting gas, the process is of little value. Before sealing the last door all draperies which have not been removed must be spread out and all drawers, closet doors, etc., widely opened.

Sulphur dioxide or formaldehyde gas may be used to disinfect the room. If the apartment is bare and contains little decoration the former may be employed; if the reverse is the case the latter is to be preferred. If sulphur disinfection is chosen, four pounds must be used for each 1,000 cubic feet of room space. A simple method of generating the gas may be arranged as follows: Two or three bricks are laid upon the bottom of an ordinary wash tub and upon these is placed a dish-pan or other metal receptacle which is to hold the sulphur. The tub should contain enough water to cover the bricks and the bottom of the pan, so that there shall be no danger of fire. For this reason the vessel which holds the sulphur must never be placed upon the floor. The sulphur is to be broken in small pieces, over which alcohol is poured and set on fire by touching a match to the mixture. The operator should stand at as great a distance as possible while applying the match. If enough alcohol is used the sulphur will be almost entirely consumed, and it is important that the pan should not contain too much sulphur, as in this case the combustion will not be complete. On this account it is better to use two or more pans for the sulphur if the room is large. To produce proper disinfection it is necessary that moisture be present, and to provide for this, unless the weather is damp, we must supply this lack. This may be done by boiling water over a gas stove or by pouring boiling water from one vessel into another in the room just before the disinfection is begun. Another method is to place a vessel of water a few inches above the burning sulphur. The sulphur should always be prepared so that it may be at once set on fire after the moisture has been supplied. After lighting the sulphur the room should be immediately closed and the door of exit sealed as described above.

If formaldehyde gas is employed it may be generated from tablets in a specially designed lamp or generated from formalin in an apparatus which sends the gas rapidly through a tube passed into the keyhole of a door. The latter method is preferable but less practicable than the former.

Whichever method is chosen the room should remain sealed for at least 8 hours. Even at the end of this time care must be exercised in entering the apartment and in so doing one should wrap the face in a wet towel, pass quickly

to a window and open it, allowing the gas to escape and the fresh air to enter.

Since the discovery of vaccination by Jenner in the last decade of the 18th century we have had at our disposal a practically absolute preventive of smallpox and since that time the disease has become a rarity in districts in which the procedure has been systematically instituted. Consequently too great insistence cannot be laid upon the necessity for the routine performance of the operation. All children should be vaccinated at from 3 to 5 months of age, every 7 years thereafter and in the intervals whenever smallpox is prevalent; one should never be satisfied with an unsuccessful attempt. While vaccination does not always protect, the disease, as it occurs in those who have undergone the operation, is very rarely severe.

Treatment. Since no means exists of shortening the disease when once infection has taken place, the treatment is to be directed at the control of the symptoms and the prevention of permanent scarring. At the onset the patient should be isolated and put to bed in an airy room, the temperature of which should be kept constantly at about 65° F. (18.5° C.) and the bowels should be opened by repeated fractional doses of calomel or other mild laxative, to be followed by a saline, if necessary. The symptoms of the first stage which need special attention are the pain, the vomiting, the diarrhœa and the cerebral manifestations. The pain may be relieved by the administration of acetphenetidine, acetanilide or salipyrine, usually in combination with caffeine to prevent heart weakness. Morphine may become necessary in severe instances. The ice cap to the head and the application of an analgesic liniment, such as equal parts of menthol, hydrated chloral and camphor, may prove beneficial. The vomiting may be controlled by swallowing small pieces of cracked ice, by minute doses of phenol, hydrocyanic acid or cocaine or by frequent sips of iced champagne, and the diarrhœa by means of bismuth naphtholate or iodophenolphthaleinate (dose of either gr. v to viiss—0.33 to 0.5); bismuth subsalicylate or subgallate in connection with small doses of opium may also be employed to relieve this condition. The nervous symptoms may be rendered less distressing by potassium or sodium bromide or hydrated chloral, any of which may be given *per rectum* as well as by mouth. Sulphonmethane is also useful and in the extreme instances the employment of morphine or opium in small doses may be necessary.

Cool sponging, tepid tub baths and the ice helmet are also useful in the treatment of the cerebral manifestations.

The temperature is seldom high enough to cause alarm but, if necessary, it may be reduced by the application of the ice coil over the precordium or by cool sponging. Rarely is cardiac weakness an early symptom but should this be the case stimulants, such as caffeine, alcohol or strychnine, may be given hypodermatically.

The dryness of the mouth will be alleviated and the activity of the skin and kidneys will be favored by frequent cold drinks which should be offered at intervals.

The eruptive period. During this stage the problem confronting us consists of two parts, the treatment of the cutaneous manifestations and that of the constitutional condition. In the former the chief object is to prevent permanent scarring and numerous methods have been employed with this end in view. Of these the simplest and one of the most efficacious is to cover the skin with a thin gauze compress which is kept moist with cold 1 to 5,000 to 10,000 mercury bichloride or 1 to 200 or 300 phenol solution and is covered with oil-silk. For the face a suitable mask can be made. The phenol has the especial advantage of neutralizing the unpleasant odor of the disease. The wet compresses have a certain analgesic effect and are grateful to the patient. Clipping of the hair is necessary if the eruption involves the scalp to any extent. Of other means of treating the skin the employment of wet dressings of weak thymol or potassium permanganate solutions may be mentioned. Many more drastic applications have been advocated, such as touching the eruptive points with pure phenol, painting with silver nitrate solution or ½ strength iodine tincture and even opening the pustules and touching them with stick silver nitrate, but none of these is likely to yield better results than the simple cold wet compress.

Dusting powders have a place in the treatment of the eruption especially in its early stages. Of these boric acid, bismuth subgallate, talcum, or a mixture of phenol 1 part and lycopodium powder and zinc oxide of each 16 parts are to be recommended. Scrub baths given daily are said to prevent pitting since they hinder the formation of the vesicles and pustules; they are, however, a drastic measure. Continuous warm baths have also been advocated. The administration of xylol—100 to 120 drops (6.66 to 8.0) in divided doses every 24 hours is said to diminish the mortality, to lessen the characteristic odor of the disease and to tend to arrest the suppurative stage, thus influencing the occurrence of pitting.

The variolous manifestations in the nose, mouth and throat require the external application of cold and moisture and attention to the cleanliness of the nasal and buccal cavities. Antiseptic sprays and mouth washes such as Dobell's solution or diluted liquor antisepticus are useful here and astringent washes such as dilute solution of potassium chlorate or iron perchloride may be employed. The discomfort attendant upon the appearance of the eruption in the mouth may be alleviated by means of sucking bits of ice and by emollient and demulcent drinks such as thin oatmeal gruel and teas of arrow-root or marsh-mallow. If ulcers appear they may be touched with a 20 percent. silver vitellin (argyrol) solution. Localized collections of pus in the pharynx or tonsils should be immediately opened and drained.

The conjunctival eruption should be carefully treated by means of continuous compresses of cold boric acid solution (½ saturated) and by instillations of a few drops of a 10 percent. argyrol or of a 1 to 500 methylthionine hydrochloride solution. Silver nitrate solution may be used but is painful and no more efficacious than the silver vitellin. If the eyelids tend to become gummed together this may be prevented by anointing their margins with vaseline, either plain or containing 5 percent. of boric acid.

After the crusts have formed the patient should be advised to let them fall spontaneously for if they are removed before they are wholly loosened the pitting is apt to be more pronounced. Children should be prevented from scratching by bandaging their hands loosely in gauze. The itching during the period of crust formation may be relieved by means of the dusting powders suggested upon the previous page or by warm baths to which bran may be added and the scales may be protected from irritation by means of light dressings of carbolized vaseline or vaseline containing 5 percent. of boric acid. If the scabs become detached for any reason before the skin beneath has wholly healed, the suppurating surface should be cleansed with a mild antiseptic solution and dressed, until the skin has reformed, with borated vaseline. Exuberant granulation tissue should be touched with stick silver nitrate and dressed antiseptically.

The treatment of the constitutional condition during the stage of pustulation offers several problems. The strength of the patient must be maintained by proper and sufficient nourishment and the pyæmic condition necessitates the employment of measures such as are indicated in suppurative states due to other causes. Here alcohol in the form of brandy or whiskey, 2 to 4 ounces (60.0 to 120.0), and infusum cinchonæ in large doses are highly recommended. The former may be given either diluted with water or in the form of a milk punch with egg; to the latter a few drops of dilute hydrochloric acid and spirit of nitrous æther may be added with advantage. The fever seldom needs especial treatment but should it be alarmingly high the application of an ice coil to the precordium will usually result in a considerable reduction. The coal tar antipyretics should be employed with great caution if at all. The condition of the heart should be carefully watched and should stimulation be required in addition to the alcohol, strychnine and caffeine may be given in appropriate doses and should there be evidence of collapse, hypodermatic injections of camphor dissolved in olive oil or æther become necessary. Nervous symptoms may be controlled by the bromides and hydrated chloral which may be given by rectum or by mouth as indicated. The dose of the latter must be such as to be in no danger of causing heart weakness. Tepid baths are also useful in relieving the nervous hyper-excitability.

The administration of antistreptococcus serum has been suggested as a means of combating this stage of the disease and not without reason, since the pres-

ence of the streptococcus in the contents of the pustules is common. This procedure is especially indicated in patients with grave septic symptoms; 15 drachms (60.0) may be given in 3 doses 24 hours apart or in profoundly toxic instances this quantity may be given in one day. Attempts at controlling hæmorrhages may be made by giving ergot hypodermatically or better by the internal or rectal administration of calcium chloride. The latter exerts a distinct influence in increasing the coagulability of the blood and may also be given in hæmorrhagic forms of the eruption. Its dose is 20 grains (1.33) 3 times a day. It should not be given for more than three or four days at a time.

The treatment of the complications is little different from that of similar conditions occurring independently. Œdema of the glottis may demand scarification, intubation or tracheotomy. Pneumonia should be prevented by careful management of its precursor, bronchitis, and by frequent turning of the patient upon his side to prevent hypostatic congestion of the bases of the lungs. Pharyngeal suppuration and furunculosis necessitate appropriate surgical treatment.

The treatment of smallpox by means of red light has recently been advocated, especially by Finsen, who considered the omission of this method to be little less than criminal. The idea is not new, having been exploited by John of Gaddesden in the 14th century. According to Finsen, who excluded the ordinary daylight by means of panes of red glass, daylight and particularly its chemical rays have an injurious effect upon the course of the disease since the suppuration of the vesicles is brought about by exposure to unchanged sunlight. Upon the infection *per se* the light seems to exert no action. The avoidance of suppuration, however, is most important, since the stage of pus formation is the most dangerous epoch in the disease and many fatalities result primarily from the suppuration. The method must be properly and systematically employed, but, if pus formation has already taken place or is about to begin, the red light will not abort it. Finsen considered that in ordinary epidemics this treatment will reduce the death rate by one-half. Many other observers have used the light treatment with good results while still others are much less enthusiastic in its advocation.

Other methods of treatment have been recommended with enthusiasm, among which may be mentioned that by means of intestinal antiseptics such as the phenolsulphonates, phenyl salicylate (salol), mercury bichloride, etc., and that of Talamon who applies a spray to the skin composed of mercury bichloride and tartaric acid, of each 15 grains (1.0), alcohol (90 percent.) one and a quarter drachms (5.0) and æther to an ounce and a half (45.0). With this the skin is sprayed for 1 minute 3 or 4 times a day, the eyes being protected. The surface is first washed with soap suds, rinsed with boric acid solution and dried with cotton. The treatment is begun with the appearance of the rash, and after spraying, the face is covered with 50 percent. mercury

bichloride glycerite. After 4 days the spray is used less often and after a week it is discontinued, the glycerite dressing being continued. The same observer has recommended in the confluent type of the disease baths of mercury bichloride solution lasting 45 minutes to 1 hour, internal stimulation being employed at the same time.

The serum treatment of smallpox has thus far given no results which render its use justifiable. Further advance in the elaboration of an efficient serum therapy may be made in the future.

The convalescence usually necessitates the employment of tonics and of easily digestible and nutritious food.

The diet of smallpox should be carefully regulated. During the initial fever only fluids should be allowed but in the remission, before the stage of pustulation, semi-solids such as gruels, soft-boiled eggs, meat jellies, etc., may be given. At the onset of the stage of pustulation the patient must return to fluids; it is at this time particularly necessary to maintain his strength, consequently the diet should be as concentrated and nutritious as possible.

VACCINIA.

Synonyms. Cow Pox; Vaccine Disease.

Definition. An infectious disease characterized by an eruption and produced in man by inoculation with the contents of the vesicle of cow pox. Individuals who have been successfully inoculated are, with a very few exceptions immune from smallpox, and, even if able to contract the disease, such subjects are affected with its mildest form, varioloid.

Whether vaccine disease is a separate disease or is the variola of the human being as manifested in the cow is a moot point, opposite views being held by different observers; one point is certainly evident, however, to the unprejudiced, and this is that, could vaccination be systematically and thoroughly carried out, smallpox would become an unknown disease. Unfortunately certain fanatics oppose the compulsory performance of the operation and, until these experience a change of heart and compulsory inoculation is instituted, instances of variola will be seen from time to time and, where a proper soil is offered, epidemics will occur.

That inoculation with cow pox was a sure preventive of smallpox was discovered and proven by Edward Jenner, of Gloucestershire, England, in 1796.

While, in all probability, vaccine lymph contains a specific micro-organism which is responsible for the train of symptoms which follows inoculation, no such body has yet been successfully isolated although much research upon this subject has been carried out. Various bacteria and amœboid bodies have been found in the lymph but none of these has been proven to be the essential cause of the disease, vaccinia.

In inducing vaccinia in the human being and rendering him subsequently immune to smallpox infection two varieties of virus are employed, the humanized and the calf lymph. The former is the pus from the pustule of a vaccinated human being, the latter is the contents of the pustule of the cow or calf. The latter is chiefly used at present and is preferable since the humanized virus is capable of transmitting syphilis to the inoculated person should the individual from whom the virus has been taken be unfortunate enough to be infected with specific disease. While the possibility of the transmission of tuberculosis in the same way has been considered it has never been proven.

The operation of vaccination is performed as follows: The site selected is, in the case of boys, the outer side of the arm at the junction of its upper and middle thirds. In vaccinating girls in the upper walks of life it is preferable to use the outer side of the calf. The skin over the part chosen should be sterilized by washing with soap and water, alcohol and 1 to 5,000 mercury bichloride solution, wiped with sterile water and allowed to dry. Then with a needle, which has been sterilized by heating in a gas flame, a surface one-eighth to one-fourth of an inch in diameter is lightly scratched, care being taken not to draw blood, but merely to remove the upper layers of the integument. A slight exudation of serum will follow this procedure and into this the vaccine should be rubbed for several moments. The surface should be allowed to dry and then dressed lightly with a compress of sterile gauze. The various shields sold to cover vaccination wounds should not be used. Different makers supply dried vaccine upon quills or ivory points, which may be used instead of the needle to abrade the skin. When from a reputable firm these may be employed. The health boards of certain cities furnish calf lymph put up in glass tubes and packed with a needle, a bit of wood and full directions for the performance of the operation.

The symptoms following vaccination. Shortly after the inoculation there is a slight inflammatory reaction at the site of the abrasion which lasts but a short time. If the procedure is successful and the vaccination takes, after a period of incubation, occupying usually 3 days, a small red papule appears, by the 5th to the 7th day this becomes an umbilicated vesicle surrounded by a pink areola and containing a viscid transparent fluid; by the 10th day the areola is more marked and the fluid has become purulent. The skin surrounding the pustule is often indurated and tender. Now the inflammation gradually subsides, the contents of the pustule begins to dry; about the 14th day a brownish crust forms which becomes hard and dry and falls about the 21st day, leaving a roundish depressed scar which is red at first but finally becomes whiter than the surrounding skin.

In many instances constitutional symptoms accompany the evolution of the vaccinal pustule. These vary from slight malaise and irritability with rise of temperature about the 3d day to marked prostration with a febrile

movement lasting from 1 to 2 weeks; with this there are headache, gastric disturbances, restlessness, etc. The number of white blood cells is increased and enlargement and tenderness of the axillary or inguinal glands, depending upon the site of the inoculation, occur.

The duration of the immunity conferred by vaccination varies in different individuals but it is best to re-vaccinate every 7 years and at other times whenever epidemics appear. After from 10 to 15 years a second vaccination is usually successful but the pustule and the constitutional phenomena are less characteristic. Even in first inoculations the typical result may not be attained. In such instances the operation should be performed again and repeated if necessary until success crowns the effort.

Generalized vaccinia is rare but may manifest itself as a pustular rash on different parts of the body, appearing on the eighth to the tenth day; the pustules are most abundant upon the vaccinated limb and may continue to appear for several weeks. The disease may prove fatal in children.

Complications of vaccination. Cellulitis may occur, especially in debilitated children as a result of contamination at the time of operation or subsequently and may necessitate the employment of radical surgical measures. Erysipelas is a serious complication and great care should be used in vaccinating if the disease is prevalent. If the disease exists in the family of the subject about to be vaccinated the operation should, if possible, be postponed. During the evolution of the pustule various skin eruptions may appear and, in certain instances, dormant diseases, such as tuberculosis and hereditary syphilis, have manifested themselves.

The occurrence of tetanus as a complication has been noted in a number of instances most of which were inoculated with lymph from one particular producer. The possibility of such contamination should render us especially careful to use lymph from reputable sources only.

The treatment of vaccinia is wholly symptomatic. Mild instances need no treatment whatever. Those in which the constitutional manifestations are unusually severe should be kept in bed and on a fluid diet during the febrile movement. The bowels should be kept open and the kidneys and skin active. The local condition and the glandular swellings should be treated in accordance with proper surgical methods and for the complications the means ordinarily applicable should be employed.

CHAPTER II.

CONSTITUTIONAL DISEASES.

GOUT.

Synonym. Podagra.

Definition. A painful constitutional disease, acute or chronic, due to an abnormal quantity of the antecedents of uric acid in the blood, resulting in various symptoms, of which joint inflammation is the most prominent and characteristic, together with the deposition of urates in the neighborhood of the articulation.

To Wallaston's discovery in 1779 that the deposits at and around the joints were composed of urates we date our knowledge of this disease and its pathology.

Ætiology. In many individuals there is an hereditary tendency but the disease may also be earned. In more than half the patients a family history is obtainable.

The disease is more frequent in males than in females and it is through the male line that the hereditary tendency is more likely to be transmitted. Gout is seldom seen in young subjects and usually shows itself after the age of forty. The stigmata, however, of the gouty diathesis may be detected as early as puberty. The most common causes of acquired gout are excessive eating, particularly of meats, and intemperate drinking, combined with sedentary habits, yet these factors are by no means essential to its occurrence. It is also true that not all who possess the hereditary tendency suffer for the indiscretions of their forbears, for proper mode of living may act as a preventive.

Over-drinking is a chief factor in the production of gout, but the form in which the alcohol is ingested has a certain influence on the incidence of the disease. Heavy ales and beers, such as those brewed in England, are more likely to bring on gout than are the lighter malt liquors produced in America and Germany. Whiskey is less to be avoided in this connection than heavy wines, such as port. It is probable that the excessive carbohydrate content of these beverages is the causative factor of the disorder, resulting, as it does, in the products of gastric acid fermentation, which, upon absorption render the blood less alkaline and less solvent of uric acid.

Lead poisoning may excite an attack of gout, possibly, as suggested by Haig, because it may reduce the alkalinity of the blood.

Local traumatism to a joint, or even pressure from footwear may bring on

an attack in the injured part. The reason of the predisposition of the disease to attack the great toe joint is unknown.

Pathogenesis. With regard to the pathogeny of gout there is much difference of opinion, but most authorities unite in believing uric acid to some extent a causative factor. Whether this substance causes the train of symptoms known as "gouty" by its increased production in the body, by its diminished excretion, or both, is not certainly known. We are not unanimous in thinking that the sodium biurate which forms the tophus is the cause or the result of the pathologic process, but Sir William Roberts' theory that uric acid normally does not as such circulate in the blood, but only as a soluble quadriurate of some base, is probably correct. In normal urine, uric acid is always present in the form of sodium, potassium or ammonium quadriurate. These are unstable salts and in the presence of the normal sodium chloride solution of blood or lymph become converted into the more stable and less soluble biurates. In health the quadriurates are too soon removed to become converted. Evidently, therefore, in gout, something delays excretion long enough for them to be changed into biurates, and this takes place in those tissues, such as the synovial fluid, the cartilage and the fibrous tissues, which contain the greatest proportion of sodium salts. The tophi, therefore, occur first where there is plentiful synovial fluid, then in the cartilages, then in the fibrous tissues.

If we consider all sorts of conditions, presenting more or less resemblance to gout, as phases of this disease we have a sort of anchorage, but one which permits of much deviation. If we examine the various statements made as to the disease we may find the following fairly representative. "In gout we have a disease which may give rise to almost any symptom or affect almost any organ or function." If we start with the patient the following has been presented: The gouty individual is one whose general metabolism is unstable and this instability may be present in one or more of the great physiologic systems (digestive, circulatory, nervous, etc.). If these statements represented the actual state of our knowledge, one might readily assume that we had abandoned our anchorage and were adrift. Recently, Woods Hutchinson has offered the following statement as a solution of the difficulties which beset us, defining gout as "a disturbance of health associated with the presence of excessive amounts of urates in the urine." The merit of this definition lies in its presenting a material point from which we may start. It fails to state what the *corpus deliciti* is, although deductively it is not uric acid. It fails because it does not embrace within its limits those instances of undoubted goutiness in which "the presence of excessive amounts of urates in the urine" is inconstant, and it proves too much, because leucocythæmia and the renal infarcts of the newly-born are included by the definition, but are admittedly not involved in the question, so far as the symptomatology is concerned.

However, as a starting point this statement is useful and an effort will be made to find a working hypothesis upon which we may base a plan for relief of symptoms and disabilities consequent upon disturbed metabolism.

Uric acid for over a century has at once been the base and capstone of all pathologic theory with regard to gout. At present we are in better position to reach a practical working basis for therapeusis.

1. We are reasonably certain that uric acid, as such, is not toxic. This fact is now almost universally conceded.

2. The presence of a uric acid sediment in the urine does not of necessity indicate a gouty tendency, for the power to hold uric acid in solution in the urine depends largely upon the amount of pigment and the percentage of salts contained in that excretion.

3. A nitrogen-free diet does not cause an abolition of uric acid excretion. And finally,

4. The excretion of uric and phosphoric acid goes on hand in hand—at least during attacks.

Examining these propositions *seriatim* we see that, while uric acid *per se* is not toxic, it is quite possible that earlier and less oxidized bodies are probably so. Therefore the increased excretion of uric acid, signifying the increased or complete oxydation of uric acid antecedents and their elimination as uric acid, should be accompanied by a relief of symptoms referable to the presence of these antecedent bodies in the organism. In practice this is found to be true.

Next, the observation of coincidence of marked symptoms and diminished uric acid excretion with periods of relief and increased uric acid excretion points out that delayed or imperfect excretion of uric acid is concomitant with exaggerated pathologic conditions. Since, as has just been stated, uric acid is not in itself toxic, its forbears must be responsible for the symptoms.

As a nitrogen-free diet is not followed by an absence of uric acid from the urine, the formation of uric acid in the body from substances contained therein must be conceded. This uric acid is very properly termed endogenous uric acid and is independent of the character of the food ingested. It is the exogenous uric acid, the amount varying with the food and modified by various factors which act on digestion and absorption, when the patient is on ordinary diet, that completes the other portion of the total uric acid excretion.

As uric and phosphoric acid excretion bear a fairly constant relation to one another, the clue is at once given as to the probable source of endogenous uric acid. This source is the cell nuclei and the products of their destruction are both uric and phosphoric acids as they appear in the urine. Therefore the breaking up of these nuclei gives rise to the appearance of uric acid and the xanthin bases, which, as a group, constituting the alloxur bodies, are termed purins because they all contain the radical $C_5 H_4$.

Since the phosphoric goes hand in hand with the uric acid excretion, it would be as logical to direct therapeutic attention to the former as to the latter. So far as the endogenous uric acid is concerned we may define gout as a toxæmia of varying causation, accompanied by the formation of an excess of urates, this excess being due to the breaking down of the leucocytes and fixed cells in the attempt to neutralize the poison.

Now as to exogenous uric acid; obviously this comes from without and constitutes the source of the smaller moiety of the total output of uric acid. Here the ingestion of food, either purin free or of small purin content, must be considered. Obviously, were the attempt made to regulate the diet according to the amount of purin nitrogen found in food, various articles of food would be permitted which experience has shown to be detrimental to the patient. And after all, the patient must not be disregarded, for the metabolic reactions of the gouty are indubitably abnormal. From this it is clear that an attempt to regulate the output of exogenous uric acid by altering the intake of purin containing substances must be futile when we consider that there are factors influencing metabolism in the gouty which are important.

Recently there has been a tendency on the part of some observers to return to the mechanical theory of gout. This theory advances the idea that the urates deposited in the joints and the ligamentous structures about them act as foreign bodies, obstruct the lymph vessels, cause irritation, and exert pressure upon the articular and peri-articular tissues and interfere with their nutrition, thus explaining the pain, redness and swelling and accounting for the degenerative manifestations which result later. Old deposits of the biurates are not of necessity painful but it is the opinion of most observers that fresh deposits of these substances are always accompanied by painful symptoms.

Pathology. While there are few organs or tissues which may not be the subject of gouty changes, the characteristic manifestation of the disease is in the acutely inflamed great toe, the swollen and reddened appearance of which has but to be but once seen to be always remembered. Less usual is a like condition of the thumb.

The manifestations of chronic gout are less typical and may be difficult of differentiation from those of chronic rheumatism. Deposits of the urates, however, are pathognomonic of gout. These occur with greatest frequency in and around the joints, involving the cartilages, ligaments, tendons, bursæ and last of all the skin and connective tissue. Often we find the tophi about the finger joints or in the aural cartilages. Upon microscopic examination the cartilages are seen to be infiltrated with sodium biurate crystals. The tophi may ulcerate through the skin of the knuckle joints and they are frequently accompanied by a tendency of the fingers to be drawn to the ulnar side and of the toes toward the outer side of the foot; this latter being a late

manifestations and frequent, as well, in arthritis deformans and a result of the fact that the abductor muscles are more powerful than their antagonists. The tophi should not be mistaken for Heberden's nodes which are of different origin and occur in arthritis deformans. These are, however, more prominent and painful in gouty subjects. Various exostoses and enchondromata or "lippings" from the cartilage covering the articular extremities of the bones, especially of those of the fingers and toes, may be observed but should not be confounded with true tophi.

The kidney of gout is the granular or cirrhotic kidney and is not in any respect different from the ordinary kidney of so-called chronic interstitial nephritis.

The heart is often the seat of an hypertrophy, especially of the left ventricle, and its valves may show deposits of urates upon their edges. The arteries are usually sclerosed, which fact is due to the toxic influence of the xanthin bases.

Symptoms. Patients in whom attacks of gout are frequent, often are able to foretell a coming attack, learning from experience that certain symptoms, which differ in different individuals, are premonitory; headache, neuralgic pains, disordered digestion, cardiac irregularity or palpitation, a tense pulse, a feeling of weariness, depression, etc., may be mentioned in this connection.

Any circumstance which tends to lower vitality, or intemperance in eating or drinking, may bring on an attack.

Usually the first symptom noted by the patient is a pain in a joint, usually in the metatarso-phalangeal articulation of the great toe. Its onset is sudden and its character is sharp and stabbing. A chill may usher in the attack. Accompanying the pain are the symptoms of local inflammation; heat, redness, swelling and tenderness, although there may be pain without these manifestations, or there may be local signs with discomfort. The attack usually begins at night and, if the first, it may not be typical and therefore remain undiagnosticated. As morning comes on the pain becomes less, perhaps to recur during the night following, and for from four days to a week the cycle continues—worse at night, better during the day. With the attack there is commonly a moderate rise of temperature (100° to 102° F.—37.8° to 38.4° C.), which may continue, with morning remissions, as long as the acuity of the symptoms persists. After a few days the pain and other symptoms subside and the skin of the affected part desquamates.

The urine during the attack is scanty, high in color and specific gravity, may contain a little albumin and, if allowed to stand, is likely to show a sediment of urates and uric acid. Glucose also may be present. After the attack the amount of uric acid excreted through the urine may be increased; before its onset and during its acuity this may be diminished.

Gouty pharyngitis may be the only manifestation of an acute attack and

is impossible of differentiation from other forms of sore throat which show only redness and slight swelling.

The local symptoms of an attack of acute gout may suddenly disappear and manifestations due to derangement of the internal organs—notably the stomach, heart, brain or bladder—may as suddenly appear. In such instances the gout is described as "retrocedent" or "metastatic." The symptoms referable to the heart may be pain, dyspnœa or irregularity of action; those referable to the stomach, pain, vomiting, or diarrhœa; those referable to the brain, various meningeal disturbances; and those referable to the bladder, those of inflammations of that organ or of the prostate gland. Skin eruptions (eczemas) have been described in this connection.

Atypical Gout. Certain symptoms not distinctive of gout may appear in persons of gouty tendency and in such patients are of undoubted gouty origin. These include almost any mentionable symptom; of them the most usual are various muscular pains, headaches, digestive disorders, burning and tingling of the palms and soles, *digitis mortui.*

Certain changes, not characteristic, occur in the organ of vision as a result of the disease—except rarely, in patients in whom there are deposits of the urates in various tissues of the eye.

Chronic Gout. When a patient has continued to have numerous attacks of gout changes take place in his tissues—as described in the section on pathology —such as the deposits about the joints and in the cartilages, the deformities of the extremities and the morbid degenerations of the kidneys and blood-vessels.

Treatment. The treatment of gout resolves it into the management of the acute attack and that of the gouty tendency

a. The treatment of the acute attack. When the attack occurs in a healthy person, in whom there exists no reason for limiting our efforts, the indication is to prescribe the drug or drugs which will most quickly relieve the patient of his misery. Colchicum will relieve the pain and in the salicylates we have agents which will hasten the elimination of the purin bodies which are the *causa causans* of the attack. The following capsule is recommended: ℞, colchicinæ salicylatis gr. $\frac{1}{100}$ (0.0006), methylis salicylatis minims vi (0.4); make one capsule. Signa—Take one every hour until pain is relieved.

When the acute symptoms have abated the indication is to relieve the system of the accumulated purin bodies and to prevent their further retention. (See treatment of chronic gout and purinæmia, p. 263.)

In patients who have suffered frequent and repeated attacks of gout and whose heart and arteries are the seat of sclerotic changes, glyceryl nitrate (nitroglycerine) $\frac{1}{100}$–$\frac{1}{50}$ gr. (0.0006–0.0012) and strychnine $\frac{1}{80}$ to $\frac{1}{20}$ gr. (0.002–0.003) at the intervals required by the severity of the degeneration, should be prescribed to dilate the arteries and to counteract the depressant effect of the colchicine.

There is no reason why an attack of acute gout should not be cut short for there is no danger of the disease "going to the heart" unless we fail to open the arteries and to provide against the myocardial degeneration.

The use of nucleinic acid in the treatment of the uratic deposits has been suggested and favorable results are reported. Nuclein substances, themselves, since they contain abundant purin bases, are not suitable in this connection. Base-free thymic acid has been used in attempting to lessen the size of the tophi, which seem to diminish under its influence, while the excretion of uric acid is increased.

Quinic acid, particularly quinic acid anhydride, may be used in acute gout in doses of 150 grains (10.0) per day. It is reported that by its administration the pains are greatly ameliorated and the local signs about the joints are lessened. This substance regularly diminishes the output of uric acid.

Certain authorities recommend hypodermatic injections of antipyrine in the neighborhood of the affected joint, since this drug, in addition to its analgesic effect, is said to have a specific action in gout.

The wine of colchicum seed, in beginning dosage of one-half drachm (2.0) in combination with potassium iodide or sodium salicylate, is frequently used in acute as well as in chronic gout, the dosage of the two latter being up to one drachm (4.0) a day in divided doses.

For the pain acetphenetidine (phenacetine), antipyrine salicylate (salipyrine), and saligenin tannate have their advocates. Hypodermatic injections of morphine will always relieve but these should not be given unless absolutely necessary.

The insomnia may be controlled by the bromides or hydrated chloral.

The diet during the attack should consist entirely of milk and vichy, equal parts. Of this eight ounces (250.0) should be given every two to four hours. This tends to act as a diuretic and to cause the colchicum to be absorbed into the circulation rather than to be excreted through the intestine without accomplishing the effect for which it is administered. It is very important that the patient should drink copiously of water.

Local Treatment. The joint should be protected by a generous swathing of cotton, and various local applications, warm rather than cold, may be made, always remembering that it is very important that the skin should be kept intact. Painting with collodion, (not more than two coats) either with or without the tincture of iodine, may afford relief as may also any of the following applications: Sodium bicarbonate, 1 to 16 of warm water; equal parts of guaiacol and glycerin; one part of the extract of belladonna to eight of glycerin; oil of peppermint; chloroform and olive oil, equal parts; belladonna liniment and chloroform, equal parts. Local applications are likely to afford less relief than in rheumatism and are less effective cold than warm. At times the tenderness is so marked that not even the bed clothing

can be borne upon the afflicted part; in such instances the use of a frame to support the sheets is advisable.

PURINÆMIA.

Synonyms. Lithæmia; Uricacidæmia; Uricæmia; American Gout; Goutiness.

Definition. A disease of rather indeterminate nature dependent upon the presence in the blood of partially oxydized food elements more especially the biurates.

Ætiology. The condition is caused by intemperate eating and the abuse of alcohol, combined with too little exercise and a sedentary habit of life. The accumulation of the urates is rather due to their production within the body as a result of faulty metabolism than to a too great ingestion of substances which contain these bodies.

Symptoms. Various indefinite symptoms characterize this disease. One of the most constant is digestive disturbance which may be manifested by intestinal fermentation, constipation, etc. Headache is frequent and may be accompanied by dizziness, ringing in the ears, insomnia, numbness and tingling of the hands and feet, neuralgias and indefinite pains in various joints and muscles of the body. Neurasthenic symptoms are common as well as irritability of temper. Dermatoses, such as eczema, psoriasis and pruritus ani, are often observed. Palpitation, cough and loss of flesh and strength may be present. The urine usually contains less uric acid than normal, and there is frequently an excess of indican due to the digestive derangement. There may be traces of albumin and a few hyaline casts. Crystals of calcium oxalate are often seen.

Treatment. The keynote of treatment lies in (1) limiting all toxic influences and formation of toxins, particularly in the alimentary canal, in order to minimize the retrograde metamorphosis of the body nucleins; (2) preventing the absorption of all toxic material; and (3) promoting the elimination of toxic agents.

Diet. The diet should consist of purin-free foods in so far as possible; these are, milk, eggs, butter, cheese, white bread, rice, sago and fruits. Those containing under two-hundredths percent. of purin nitrogen are beer, stout, onions, asparagus, brown bread. Under three-hundredths percent. oatmeal, lentils, beans, peas. Under five-hundredths percent. salmon, cod, pike, halibut, mutton, veal, pork, ham, turkey, chicken. Under one percent. liver, steaks, soups. Under four percent. sweetbreads. Obviously were the attempt made to regulate the diet according to the amount of purin nitrogen found in food, various articles would be permitted which would prove detrimental; also the patient must not be disregarded, for the metabolic reactions in this gouty condition

are indubitably abnormal. Hence it is clear that any attempt to regulate the output of uric acid formed in the body by altering the intake of purin-containing substances must be futile when we consider that there are factors influencing metabolism in our patients which are important. Finally the clinical observation that the appearance of an excess of uric acid and urates in the urine is generally coincident with the diminution or disappearance of the symptoms leads to the conclusion that the elimination of bodies antecedent to uric acid by agents which increase the uric acid output as uric acid is also not to be forgotten.

In considering endogenous uric acid, unquestionably methods whereby the toxæmia which results in nuclear destruction is obviated should be considered. Metabolism, in character at least, is profoundly altered by the ingestion of various substances such as lead. Waters containing lime and iron are well known to be harmful. Indirect poisons are also potent as well as direct. The effect of alcohol in purinæmic subjects is not wholly due to the alcohol *per se*, but more probably to some of the more readily fermentable carbohydrates, as the æthers, esters or acetone groups which are found in the sweeter or more fruity wines used by the rich, or accessory products found in the malted beverages drunk by those in moderate circumstances. The logical inference is that substances capable of producing intestinal putrefaction, and consequent autointoxication, should be prohibited.

If the endogenous uric acid is restrained as to its amount by preventing unnecessary waste from autointoxication, exogenous uric acid can be readily controlled. Evidently a prohibition of red meat, as has been the custom, should diminish the excretion of exogenous uric acid, but we are confronted by the fact that the ingestion of nitrogen is essential to the existence of the organism and so far we cannot make use of that contained in the atmosphere. The distinction between animal and vegetable foods is more apparent than real, for the glutens (vegetable albumins) at least, are assimilated with more difficulty than animal albumins, and the excess of carbohydrates leads to intestinal fermentation and putrefaction. Clinically the prohibition of red meat has not been a success, and modern research tells us why this is so. To make a positive statement, it can be safely said that animal food in moderation is advisable. Pickled, salted and fried meats are forbidden. Fish is excellent, even oysters and lobsters are permissible if fresh. All vegetables and raw fruit, if apart from meals, are allowable. Tea, coffee and cocoa in moderation are permitted. Alcohol in excess and inferior wines are injurious. Malt beverages should be supplanted by cider, in quantity not exceeding a pint (250.0) each day. As has been pointed out, the quantity, rather than the variety of the food, is to be limited. All rich, highly-seasoned, greasy and twice-cooked foods, strong soups, cooked tomatoes, rhubarb, sweet cooked foods are to be avoided. Large mixed meals of animal and farina-

ceous foods with fruit and wine, especially if the latter be sweet or fruity, provoke the disease. Plainly cooked animal food, preferably roasted or grilled, and limited to the quantity necessary for nutrition, is eminently satisfactory. Two ounces (60.0) per day of good whiskey, well diluted, will satisfy those habituated to alcohol. Excess of water should be taken only apart from meals. Sedentary habits interfere with digestion and assimilation and lead to the ingestion of more food than the muscles and liver can burn up. Consequently an out-of-door life, with such exercise as moderate bicycling, golf and the like, is to be recommended. In fact, excessive food, improper forms and amounts of alcohol, and lack of exercise are factors which lead to gout and the purinæmic conditions which are earned rather than inherited. The last therapeutic fact which calls for comment is the method by which an excess of uric acid, and especially its forbears, is remo ed from the tissues. The alkalies and salicylates are our chief reliance in that they not only make these products more soluble, but also because they favor their elimination. The prolonged use of alkalies is obviously disadvantageous so that we must rely chiefly upon the salicylates. One of the most excellent and useful of the forms of these salts is saligenin tannate, a substance obtained from several species of *Salix* and *Populus* (nat. ord. *Salicaceæ*). It is a decomposition product of the glucoside salicin saligenin in chemical combination with castaneotannic acid. Over salicylic acid it presents the advantage that, while equally efficacious, it does not disorder the digestion nor cause untoward symptoms. It is preferable to the salicylates in that it is antiseptic, while the latter are not, and it easily splits up. Over both it offers the advantage of larger dose and longer period of administration. The dose is 15 grains (1.0) in powder twice or three times daily after meals. The bowels should be kept open by means of sodium phosphate, cascara, podophyllin, etc., as in all conditions where free elimination is necessary.

Piperazine water will be found useful in certain patients but the administration of lithium in tablet form or otherwise is likely to yield little or no result; the bitter tonics, such as nux vomica, gentian or cinchona, are often useful. The headaches and other pains may be controlled by antipyrine salicylate (salipyrine) in 10 grain (0.66) doses repeated. Morphine should be used only as a last resort.

For certain patients a sea voyage or change of climate will prove of benefit.

DIABETES MELLITUS.

Synonyms. Glycosuria; Melituria.

Definition. Diabetes mellitus is a chronic disease characterized by an excessive secretion of urine, which contains glucose, and which is the result of a disordered metabolism.

Ætiology. The disease is more common in males than in females, and is most frequently seen between the ages of 30 and 60, although it may occur in childhood and even in infancy. Certain races, notably the Hebrew, possibly because this is an essentially dyspeptic people, are more prone to the disease than others. Heredity seems to influence its occurrence and, while the disease is seen more often in the well-to-do, it has also been observed in those of poor circumstances. It is a rare condition but seems to be becoming more common. Its definite causation is very obscure but it is in essence a disease of incomplete oxidation and is nearly related to gout and purinæmia. The fact has been observed that diabetics often alternate between the excessive elimination of urid acic and of sugar.

Pathogenesis. Notwithstanding the immense amount of research done in connection with diabetes, the pathology of the disease remains exceedingly obscure; however, we may consider as recognizable three classes of the morbid condition.

a. The pancreatic form.

b. The alimentary form.

c. The nervous form.

Disease of the pancreas has for a number of years been known to be a factor in the production of glycosuria. Opie has demonstrated that particular elements in the pancreas, namely, the islands of Langerhans, must be affected to produce this symptom. The most frequent pathological change in these elements which results in the appearance of sugar in the urine is a sclerosis or degeneration of other form, hyaline, for instance. The glycosuria appearing in instances of cysts of the pancreas, cancer, etc., is probably the result of a temporary involvement of these so-called islands. Also the frequent association of arteriosclerosis and diabetes renders it probable that this condition, by its interference with the nutrition of the pancreas, may result in changes which lead to diabetes.

Alimentary diabetes is brought about by some disorder of the digestive system producing an interference with proper carbohydrate metabolism, which results in an hyperglycæmia, which is due to the presence in the organism of an amount of glucose with which the body is unable to cope. For instance, in certain infectious diseases, exophthalmic goitre, alcoholism and lesions of the liver, the presence of an amount of sugar, of which the normal organism might easily dispose, in these conditions may result in glycosuria, due possibly, as pertinently suggested by Pearce, to a temporary interference with the function of the pancreas due to circulatory or toxic disturbances of the islands of Langerhans.

The nervous type of diabetes occurs in various diseases of the central nervous system; tumors, and other lesions of the floor of the fourth ventricle; traumatic and other neuroses, acromegaly, etc.

Unfortunately the facts known to us concerning this disease are few but a summing up of our knowledge would seem to show, according to Edsall, that in the pancreas resides an important influence over carbohydrate metabolism. How this organ acts is not known but it is not merely through the production of a glycolytic ferment. It is also apparent that carbohydrate metabolism is associated not only with the pancreas but with other organs, notably the liver, as well, and that the more deeply the subject is studied the more complex does it become.

Pathology. The only definite pathology, so far as is at present known, is shown as a sclerosis or degeneration of the islands of Langerhans in the pancreas. Also this organ may be atrophied, the seat of an interstitial inflammation, of malignant growths, or cystic.

The liver is often congested, cirrhotic or the seat of fatty or amyloid degeneration.

The kidneys, while they primarily have no influence over the disease, are frequently found in a state of hyperæmia, catarrhal inflammation, or, more rarely, may be in a state of interstitial inflammation.

The lungs may present advanced tuberculous changes or may be the seat of a pneumonia.

The heart is often affected with an interstitial myocarditis, fibrous or fatty.

The brain may be congested or œdematous, the seat of small hæmorrhages or softened. Tumors of the pons, the medulla, or the cerebellum have been observed.

Symptoms. Often the first symptom noticed by the patient is an excessive passage of urine, the characteristic urine of a diabetic being light in color, sweetish in odor and taste, and of high specific gravity. It contains glucose in varying quantity and perhaps albumin. The urea and uric acid are often increased. Cramps in the legs may be observed (Unschald's sign).

Excessive thirst, due to the increased elimination of fluids through the kidneys, and an abnormally large appetite are frequent symptoms.

Itching of the skin, especially about the vulva in women, and the prepuce in men, where this symptom is due to the irritation of frequent urination, is common and likely to result in eczema.

The breath may have a sweetish odor and symptoms of indigestion are common; vomiting may occur. The bowels are usually constipated, but diarrhœa may be present.

There is often emaciation and the patient complains of bodily weakness.

The lungs frequently are the seat of a chronic bronchitis and complicating pulmonary tuberculosis is common, due to the fact that the powers of resistance of the organism to the tubercle bacillus are lessened by the disease and the restriction of the diet, rather than to any direct influence of the diabetes itself.

Outbreaks of boils and carbuncles are not rare; the former may occur

early in the disease but the latter seldom appear until the later stages. It should be remembered that during the course of a carbuncle in a non-diabetic patient glycosuria may be temporarily present.

Diabetic gangrene is a symptom not infrequently met. It begins in the extremities, usually the toes, and while it may appear spontaneously from chronic proliferative endarteritis, is usually the result of traumatism, often one of very slight character. The gangrene is usually of the dry or senile type, though moist gangrene has been observed.

Coma is a serious symptom; usually it appears in the later stages and often results in death. Its onset may be sudden or gradual. If the latter, the prodromata are dizziness and irritability, the patient's condition becomes more and more stuporous and finally ends in profound coma. Convulsions and delirium are rare. While many theories have been advanced as to the causation of the coma the most probable one is that it is due to an acid intoxication, the result of the continued presence of oxybutyric acid in the organism.

The blood contains glucose and the red cells and hæmoglobin are likely to be diminished.

Other body fluids, such as the saliva and perspiration, contain sugar and this has also been found in the transudates and exudates in diabetic patients.

Peripheral neuritis has been described as a concomitant of diabetes.

Abnormalities of the eyes occur, such as cataract, retinal hæmorrhages, choroiditis, dilatation of the retinal vessles, retinal atrophy and retinitis.

The prognosis varies with the type of the disease, with the age of the patient and with the length of time which the affection has existed without proper treatment. Patients in whom the disease begins in early adult life are seldom cured. The chances of recovery for the patient inclined to stoutness and in whom the disease appears in middle life or later are much better. The form of diabetes resulting from disease of the central nervous system and that due to permanent sclerotic changes in the islands of Langerhans are hopeless as regards cure but not as regards improvement. The alimentary type of the disease is most amenable to treatment. While we may consider as cured the patient who no longer excretes sugar in his urine, such a one must most carefully guard against a recurrence.

Treatment. In this the first step is to ascertain with which type of diabetes we have to deal; consequently we prescribe an absolute proteid diet in connection with the drinking of plenty of the alkaline waters for five days, for diagnostic purposes. After this period of time the patient is required to present for examination two specimens of urine, one the first passed in the morning, the other the last voided before retiring at night. If the sugar content is as when first examined it is probable that we have a diabetes due to nervous lesion. Such patients are however, to some extent amenable to dietetic and hygienic treatment. If we find a smaller amount of glucose in the morning specimen

than in that passed at night the diabetes is of the pancreatic variety. If we find no sugar in the morning urine while the evening specimen shows a positive sugar reaction an alimentary diabetes confronts us.

In each of these three types of patients treatment may be considered as being *a*, medicinal; *b*, dietetic; *c*, hygienic.

Medicinal Treatment. The drugs to be preferred are those which act chemically by retarding the formation of glycogen into glucose. Of these the author prefers uranium nitrate, which may be administered in doses of ¼ of a grain (0.016) three times daily and increased gradually up to a maximum of from 3 to 4 grains (0.20 to 0.25) per day.

Jambul acts in the same fashion by delaying carbohydrate conversion and thus enabling the organism to complete the process, and may be given, in powdered form, 5 to 30 grains (0.33 to 2.00) per day and gradually increased. As much as an ounce may be administered during 24 hours. This drug is said to act well in some instances and not in others and considerable difficulty may be experienced in selecting proper patients.

Arsenic is another remedy, the action of which is the same as that of the two preceding, but which has the disadvantage that its prolonged administration is likely to produce digestive disturbances, neuritis, herpes zoster and fatty liver; it may be given Fowler's solution, 2 to 3 drops (0.12 to 0.20) 3 times Clemens' solution (3 to 5 drops—0.20–0.33—3 times a day).

Opium has enjoyed extended use in diabetes and seems to have the power to diminish the excretion of glucose. Its great disadvantages are the probability of engendering the habit and the constipation attendant upon its continued administration. The employment of codeine obviates these difficulties and this drug may be given in doses of ¼ to ½ a grain (0.016 to 0.032) 3 times a day, gradually increased. Given in connection with uranium nitrate its good effect may be augmented.

Lithium salts act by assisting oxidation and, in combination with the salicylates, are useful in gouty patients.

Aceto-salicylic acid (aspirin) in mild forms of diabetes has, according to Williamson, good effects. It should be given in acid solution—for instance in lemon juice—to prevent digestive disturbances—in doses of 5 grains (0.33) 4 to 6 times a day

Calcium phosphate and carbonate have lately been employed with good results, perhaps due to the affinity of sugar for calcium.

Potassium iodide has achieved results in glycosuria due to cerebral gummata and should also serve in the gouty form of the condition.

Antipyrine, acetphenetidine (phenacetine) and other coal tar derivatives may lessen the excretion of sugar in the nervous type of the condition because of the control which they exert over the conversion of proteid into sugar. They may also may be found useful in other varieties of diabetes. They may

be given in doses of 10 to 15 grains (0.66 to 1.00) three times a day in combination with sodium bicarbonate and preferably when the stomach is empty.

Potassium or sodium bromide may be given with good results in the diabetes of neurasthenics or in that of mental disturbance.

Lactic acid in doses of 75 to 150 grains (5.0 to 10.0) daily, dissolved in water, has been recommended by certain Italian physicians.

Gold and sodium chloride and ergot have their advocates but are not in general use.

The various preparations made from the pancreas of animals of which much was expected have so far failed to find any place in the treatment of diabetes, and the same may be said of the extract of the supra-renal body.

In concluding the discussion of drug treatment it may be said that too much medication in diabetes mellitus should not be advised. Drugs should not be given when we are able to cause the disappearance of the sugar from the urine by dietetic and hygienic treatment.

Dietetic Treatment. An exclusive diet of proteids and fats is not advisable unless absolutely necessary, for it has been proven that coma is more likely to occur in patients who are getting absolutely no carbohydrate food. When carbohydrate food is allowed a diabetic we must see to it that the organism is able to take care of it and does not excrete it as glucose. In this connection regulation of the amount of carbohydrate intake and proper exercise will do much. For instance, in an obese diabetic of the alimentary type who is accustomed to little exercise, we may at first cut out most of the carbohydrate foods until the glycosuria has disappeared and then gradually allow a return to a mixed diet, slowly increasing the patient's physical exercise the while so that he may be able thus to convert the steadily augmenting intake of starchy food. Thin patients of this type we can hardly deprive of carbohydrates, since they need a certain amount of this class of food to keep up their nutrition, otherwise this deteriorates and the diet consisting of fats and proteids alone is almost certain to engender a cirrhosis of the liver. Consequently, the thin alimentary diabetic may be allowed starchy foods in certain quantity and we should be content if we reduce the quantity of sugar in his urine to 0.5 percent.

With regard to the articles of diet which diabetics may be allowed it may be said that such food stuffs should be selected as contain: *a*, no carbohydrate whatever; *b*, very little carbohydrate or carbohydrate in easily assimilable form which may be converted by the organism. To the first class belong all varieties of fresh and salt meat, liver excepted, clear meat soups, poultry, fish, shell-fish, butter and eggs, fats and oils, and cheese.

As belonging to the second class may be mentioned the green vegetables, such as cabbage, cauliflower, Brussels sprouts, string beans, onions, cucumbers,

tomatoes, lettuce, escarole, romaine, chicory, water-cress, spinach, dandelion, beet tops, asparagus, all nuts except chestnuts, all the acid fruits, and jellies (unsweetened) prepared from meat juices and gelatin.

Many of these substances contain a considerable quantity of sugar but not in the form of grape sugar. The various sugars and starches which they contain are more easily converted than glucose and consequently are taken care of by the organism. Fortunately milk sugar is of this class and milk may be freely given to diabetics. Other sugars which are likely to prove more rapidly convertible than glucose are lævulose, the sugar of fruit and inosite, the sugar of muscle.

With regard to bread it may be said that the toast of wheat bread 24 hours old is preferable to gluten or graham breads. Gluten flour may, however, be used, to make bread or biscuit for diabetics, but it is necessary to obtain a pure gluten, which is impossible in the United States. Cakes and biscuit made of flour of the soya bean are admissible and are said to be palatable. When stale they are likely to be rancid since the flour contains an oil. Bread made from aleuronat flour is highly recommended.

Butter may be eaten by diabetic patients but it is best to limit its quantity.

Beverages. Tea, coffee and cocoa, with cream or milk and sweetened with beet, not cane sugar are allowable. Saccharin may also be used as a sweetening but not in greater quantity than $\frac{1}{4}$ grain (0.016) to the cup. Glycerin has been employed in this connection but is inferior to the above named substances.

Malt liquors, cider and other fermented liquors are not permissible since they all contain sugar or starch.

Wines which contain no sugar or only a very small quantity, such as Burgundies, Bordeaux, Rhine and still Moselle wines and dry sherry, may be allowed.

Whiskey, gin and brandy, when unsweetened, may be given if necessary. Schreiber's dietetic wines, which contain no sugar, are largely employed.

The drinking of considerable quantities of water between meals is to be encouraged. Patients who dislike ordinary water often will take large amounts of mineral waters when prescribed by a physician. For such it is wise to suggest a water containing as little mineral as possible, such as Highland Spring water.

The Potato Treatment. Some authorities believe that a diet of potatoes may be prescribed to advantage for almost all patients. One to two pounds (500 to 1000) of this vegetable may be eaten daily with the result of diminishing the thirst and the glycosuria and of improving the general condition. If a diet containing bread is resumed the symptoms recur, only to disappear upon a return to potatoes. The reduction in the sugar is said to be due to the incomplete absorption of the carbohydrate. It is also possible that the good

of the potato diet may result in part from the alkaline salts which these vegetables contain.

Codliver oil may be found helpful, especially in weak and emaciated patients, and may be regarded as a food. It acts well given in connection with brandy or whiskey.

Hygienic Treatment. Exercise within proper limits is a valuable factor in the treatment of diabetes, for sugar is burned in the muscles as well as in other parts of the body. Excessive bodily fatigue must, however, be avoided, since it results in the overwhelming of the system with oxybutyric acid which is likely to be followed by coma. Patients whose bodily strength is good should be instructed to use a pedometer and walk a certain distance each day. With proper attention to the attire pedestrian exercise may be taken almost every day in the year. A moderate amount of gymnasium exercise may be taken and such games as golf and croquet are to be recommended. The important point with regard to exercise is to take care lest it be carried to excess. Even light exercise may be impossible for the advanced and emaciated patients.

Massage is indicated in patients unable to take active exercise and in the more vigorous it may be found a useful adjunct to the other forms of treatment. It is said that under systematic massage, the quantity of urine and its sugar content may be diminished and the glucose may even be caused to disappear. Of course regulation of the diet is also necessary to produce this result.

Diabetics should clothe themselves in a hygienic manner and particular attention should be paid to the wearing of proper undergarments during the colder months. Frequent changes may be necessary since the skin in this condition excretes certain irritating substances which if allowed to remain in contact with it may induce an eczema. Proper foot covering in wet weather is a necessity.

Decency requires the taking of at least two warm cleansing baths per week and more than these will do no harm. A cool or tepid sponge, according to the temperament of the patient, may be taken daily.

Fresh air is a necessity and the diabetic should spend much of his time out of doors and should sleep, warmly covered, if necessary, in a large, airy chamber with the window open.

The various water cures and spa treatments of diabetes are often found to be valuable but their good effects are probably due to the change of air, scene and diet, together with a regulation of the mode of life, rather than to any peculiar virtue of the waters. Alkaline waters may give benefit on account of their purgative properties.

Coma. When coma is feared, either from the existence of cerebral symptoms, from a sudden diminution of the glycosuria or when acetone is present

in the urine large doses of sodium bicarbonate (1 to 2 drachms—4.0 to 8.0—3 or 4 times a day) should be given.

Coma itself should be treated by the infusion of 2 quarts (litres) of 0.9 percent. sodium chloride solution at 112° F. (44.5° C.) into the median basilic vein. If instruments are not at hand the same quantity of the solution may be given by hypodermatoclysis at 110° F. (43.3° C.) or *per rectum* at 116° to 118° F. (46.7° to 47.8° C.).

In any case the bowels should be freely evacuated in order to rid the body of toxic substances in so far as is possible and hypodermatic stimulation should be administered as indicated.

Surgery in diabetic patients. Surgical operations in diabetics are dangerous and often of unsuccessful outcome because of the co-existing endarteritis proliferans. However, if the disease is of mild type and the sugar can, by treatment, be caused to disappear, operations of necessity, such as, for instance, amputations, may be performed, but with a guarded prognosis.

DIABETES INSIPIDUS.

Definition. A chronic condition characterized by the passage of large amounts of a urine, light in color and in weight, but otherwise normal. The affection has been considered a stigma of mental degeneracy.

Ætiology. Congenital and hereditary instances of the disease have been observed. It affects young adults most frequently, being rare after middle life; it may occur in infancy. The condition is seen more often in males than in females.

Clinically two types of the condition may be described, the *idiopathic* and the *symptomatic*. The former occurs primarily and is associated with no morbid lesion; it may be met in poorly nourished children, after the drinking of excessive amounts of cold liquids, after an alcoholic excess, as a result of fright and in convalescent states.

The symptomatic type usually accompanies cephalic injuries and such nervous lesions as cerebral tumors and hæmorrhages, lesions of the fourth ventricle, syphilitic growths of brain and cord, etc. . Diabetes insipidus may also be associated with abdominal aneurysm, tumor and tuberculosis.

The pathogenesis of this condition is best explained upon the ground that it is caused by a chronic renal congestion due to some vaso-motor disorder of the blood-vessels of the kidneys which may result from direct irritation, as in lesions of the abdomen, from central disturbance, as in cerebral lesions, or from irritation of the medulla oblongata.

Pathology. There are no constant morbid changes found in this disease. Often the nerve lesions are impossible of discovery; when these are demonstrable they are usually at the base of the brain. In certain instances there

have been enlargement and congestion of the kidneys and bladder; the ureters and pelves of the kidneys may be dilated and hypertrophy of the ganglia and degeneration of the cells of the solar plexus have been noted.

Symptoms. The onset of the disease is usually gradual; more rarely it appears suddenly after a debauch or an injury to the head. The most characteristic symptoms are the excretion of greatly increased quantities of clear, light colored urine of a specific gravity sometimes as low as 1,000, and an excessive thirst. Associated manifestations which are not constantly present are a lessened perspiration and a consequent dryness of the skin, diminished salivary secretion and dryness of the mouth. The appetite is usually not abnormally large, as a rule, but occasionally it is increased. The digestion is sometimes impaired but in most instances the general health remains good. More rarely, and particularly when the cause of the disease is an organic one, weakness and emaciation are observed. There may be pains in the back, especially at the beginning of the affection, which extend down the thighs; diarrhœa, mental weakness and disordered sexual function may be noted and a subnormal body temperature has been observed.

The urine is often passed in extraordinary quantity, a daily excretion of 25 to 40 pints (12 to 20 litres) being not unusual and even much larger amounts have been observed. The color of the urine is light, this secretion at times being as clear as water, its acidity is low and its specific gravity diminished even to 1,000. Glucose and albumin are seldom found and then only in traces; inosite may be occasionally found. The solids are usually not diminished in total amount, the urea may be increased to even several times its normal quantity.

The diagnosis is not difficult as a rule, the absence of glucose in the urine and its low specific gravity easily separating the disease from diabetes mellitus. In hysterical polyuria the condition is not permanent and there are accompanying hysterical symptoms. Chronic nephritis with greatly increased urine may be differentiated by the presence of albuminuria and casts, the presence of cardiac and arterial changes and the absence of marked thirst.

The prognosis in the idiopathic instances is favorable as to the continuance of life and recovery is not impossible; many patients continue to suffer from thirst and increased secretion of urine for long periods without impairment of health. In the secondary type of the disease the prognosis depends upon that of the cerebral, abdominal or other causative lesion. Patients suffering from this form of the affection often rapidly become weak and emaciated.

Treatment. In the instances due to nervous or abdominal disease the treatment should be directed at these conditions; these, however, are difficult of cure unless syphilitic in nature when they often disappear under the administration of mercury and the iodides.

The distressing thirst may be relieved by allowing the patient to hold bits of ice in the mouth and the employment of acidulated drinks such as lemonade. It is probable that the patient will do no harm by drinking sufficient water and other innocuous fluid to keep the thirst in check. The diet should be full and nourishing and the general health should be maintained by advising warm clothing, moderate exercise in the fresh air, warm baths or cold douches, depending upon the reaction obtained, massage and avoidance of exposure. Baths and frictions also aid in relieving the lessened secretion of perspiration and the dryness of the skin. Counter-irritation at the nape of the neck or over the epigastrium, in subjects in whom the condition is the result of nervous or abdominal disease, is often useful, blisters or the actual cautery may be used, and in spinal lesions especially, the galvanic current has been warmly recommended. The current should be of good strength, one pole being placed over the neck or lumbar region and the other over the epigastrium.

Numerous drugs have been employed in diabetes insipidus. Valerian has the recommendation of Trousseau, and should be given in large doses; the dose of the powdered root being about 30 grains (2.0) 3 times a day; the fluid extract, 2 to 3 drachms (8.0 to 12.0) daily in divided doses, or the tincture in drachm (4.0) doses 3 times a day may be prescribed. The ammoniated tincture may be substituted if desired. Zinc valerate also may be employed, given in pill form in increasing doses until 15 to 20 grains (1.0 to 1.33) daily are taken. Ergot in doses of 1 drachm (4.0) of the fluid extract 3 times a day and gradually increased to double that amount is sometimes effective as is also antipyrine in daily doses of from 30 to 45 grains (2.0 to 3.0); this latter drug should be used with caution because of its depressive influence upon the heart. Opium has been recommended but there is always the danger of habit formation to be considered. It may be prescribed either alone or with gallic acid, which latter has proved effectual in some instances; 10 grains (0.66) of the acid to $\frac{1}{3}$ of a grain (0.022) of the opium may be given 3 times a day. Sodium salicylate has its advocates and favorable results have been reported from the hypodermatic injection of strychnine nitrate $\frac{1}{25}$ to $\frac{1}{12}$ of a grain (0.0025 to 0.005).

Arsenic sometimes produces good results and its use in connection with the bromides is suggested. The following formula is an excellent one. Sodium or strontium bromide 1 ounce (30.0), Fowler's solution of potassium arsenite 2 drachms (8.0), iron and ammonium citrate $2\frac{1}{2}$ drachms (10.0) cinnamon water to 4 ounces (120.0). Of this one teaspoonful (4.0) in a wine glass (60.0) of water is to be taken after each meal.

In addition it is only necessary to state that all measures, dietetic, tonic, and hygienic, which will favorably influence the patient's general condition are valuable adjuncts in the treatment of this disease.

CHRONIC RHEUMATISM.

Definition. A chronic inflammatory process, not due to bacterial infection or trauma, affecting the softer structures of the joints.

Ætiology. This affection is most frequently seen in individuals beyond middle age who are subject to exposure and whose conditions of life are poor. In a few instances it may follow acute articular rheumatism and it has been known to precede this type of disease.

Pathology. The affected joint is enlarged and stiff as a result of the thickening of its capsule and of the neighboring tendons and their sheaths; the synovial membrane may be congested and the joint cartilages eroded; there is occasionally a slight effusion. In other instances even with marked symptoms there may be little change in the joint structures. Neuritis of the nerves about the articulation may occur and with it muscular atrophy from disuse as well as from trophic disorders, and, when marked effusion is present, from pressure either upon the muscles or the vessels which supply them. In the inflammations of long standing ankylosis may take place.

Symptoms. Of these the most characteristic are pain and stiffness of the joints; these are increased in cold and wet weather; motion augments the pain but lessens the stiffness; tenderness may be present with slight swelling; redness is rare. Constitutional manifestations are not common although infrequently there may be a slight rise in temperature; in the protracted instances of the disease anæmia, digestive disturbances and neuralgia are common. As the affection progresses the stiffness becomes more marked, there is crepitation on motion and ankylosis with deformity may take place. Chronic rheumatism does not tend to cause cardiac involvement but associated fibrous changes in the valves and heart muscle are not uncommon.

The prognosis. While not dangerous to life this disease tends to progress and complete recovery is very unlikely to take place.

Treatment. Salicylic acid and its salts are of little use in this form of rheumatism although they may aid in the relief of exacerbations of the disease. The employment of drugs which benefit the patient's general condition, such as iron, strychnine, arsenic and codliver oil, is to be recommended as is the use of iodine as suggested in the section upon the treatment of arthritis deformans (p. 283). In addition guaiacol, 1 to 2 minims (0.065–0.13) 3 times a day and tincture of guaiac, 10 to 30 minims (0.66 to 2.0) at similar intervals are beneficial at times.

The diet need be little restricted, for it is important that the nutrition shall be maintained; fats, proteids and carbohydrates in the usual proportions, together with a moderate quantity of alcoholic beverages, if these are necessary to the patient's comfort, may be permitted.

Exercise out of doors should be continued as long as the condition of the

patient's joints is sufficiently mobile to render it possible. This is to be insisted upon and later its lack should be supplied by properly applied massage; vibratory massage is often beneficial.

For the muscular atrophy both the faradic and galvainc electric currents should be employed in connection with massage and passive motions.

Local applications are very necessary; the frequent application of cloths wet in cold water and covered with oiled silk is an excellent measure. Rubbing with hot water may also afford relief to the pain. The joints should be kept permanently wrapped in flannel and this protection will have an additional counter-irritant effect if occasionally moistened with equal parts of guaiacol and olive oil; dressings of 10 percent. ichthyol ointment are also effectual. The actual cautery may be employed as a counter-irritant in instances of severe pain and often the application of the high frequency electric current will afford great relief. Blistering and painting with iodine tincture have been suggested.

The hot-air treatment is frequently of much service. This consists of placing the affected joint in a specially constructed apparatus in which the temperature of the air is raised to 250° F. (121° C.) or even higher.

Hydrotherapeutic measures are very useful; those for the well-nourished subject should be different from those employed for the weak and anæmic. For the former the best procedure is to give a full bath lasting from 10 to 15 minutes beginning at 95° F. (35° C.) and gradually raised as high as can be borne; during the bath gentle massage should be given. Treatment at one of the alkaline or sulphur hot springs often results in great benefit, probably less from any absorption of the mineral constituents of the waters than from the regular life, systematic bathing and freedom from the cares of ordinary life. Hot bathing can be carried on at home and, if persistently and regularly employed, should accomplish quite as good results as spa treatment. After the hot bath perspiration should be induced by a pack in hot dry blankets. This bath may be taken daily or less often as the physician considers proper and in the intervals the joints may be wrapped in cold compresses as suggested above. As amelioration takes place a hot-air bath for from 10 to 15 minutes followed by a douche bath at 100° F. (37.5° C.) reduced to 90° F. (32.5° C.) and succeeded by a Scotch douche to the joints for about ¼ of a minute may be employed.

The anæmic patient should be given hot baths with great caution only. Two baths per week, followed by the sweats, are usually all that should be advised, and the weakening effect of the procedure will be better borne by the patient if a daily cool bath is given as follows: While standing in water at 100° F. (37.8° C.) in a room about 70° F. (22.5° C.) the patient is rapidly rubbed down with water at 80° F. (27.5° C.) which is reduced a degree or two (F.) each day. In treating the anæmic rheumatic subject the object

is to use water at as low a temperature as possible consistent with a good reaction.

Scotch douches and cold and wet compresses applied to the joints are useful adjuncts to the treatment. Hot-air baths followed by douches are also excellent.

Patients who can afford it should be advised to spend the cold and wet months in a warm climate.

MUSCULAR RHEUMATISM.

Synonym. Myalgia.

Definition. A painful affection of the voluntary muscles, their aponeuroses and periosteal attachments, involving particularly the large muscles of the neck, back and limbs and the intercostals.

Ætiology. The condition occurs most often as a result of exposure, especially to draughts and when overheated by exercise; it is consequently more common in males. The nature of the affection is not definitely known and various theories of its origin have been advanced. It has been considered as due to a lesion of the muscles themselves, of the inter-muscular septa or of the sensory nerves of the muscles. It is an interesting fact that analogous symptoms may be caused by muscular strain. Gout, rheumatism and purinæmic conditions predispose to the condition and successive attacks are not unusual.

Symptoms. The essential symptom is pain, increased by pressure and particularly by motion. While at rest there may be a dull ache or only slight discomfort but attempts to use the involved muscles result in very sharp and cramp-like pain. Swelling may be present but there are no constitutional symptoms other than an occasional acceleration of the pulse or very slight rise in temperature. The course is often short, lasting no more than a day or two or even less; it may be protracted, however, long enough to render the term chronic not inappropriate. Recurrences are common and those predisposed to the affection frequently suffer from muscular pain and stiffness in damp weather.

Muscular rheumatism occurs in several types, the following being most frequent.

Lumbago, as its name signifies, is a painful affection of the muscles of the lumbar region. It is perhaps the most common form of muscular rheumatism and may be so severe as to incapacitate the patient any movement of the back causing marked pain.

Stiff neck or *torticollis* affects the muscular tissues of the cervical region and renders any movement of the neck so painful that the patient holds the head in the position that affords himself the least discomfort and, when desiring

to turn it, turns the body; this type of the affection is frequent in the young and is usually unilateral.

Pleurodynia results from involvement of the intercostal muscles and at times the pectorales and serrati magni. The pain here is very marked for respiration necessitates continuous movement of the chest. It is usually unilateral and affects the left side more commonly. It may be differentiated from pleurisy by physical examination and from neuralgia by the absence of tenderness along the course of the nerves.

Cephalodynia affects the muscles of the scalp, *scapulodynia* those of the scapular region, *omodynia* those about the shoulder. Involvement of the muscles of the abdomen and limbs may be observed.

Treatment. The first consideration, and one in which the patient will usually heartily coöperate, is rest. The application of straps of adhesive plaster overlapping one another like clapboards and immobilizing the affected side of the thorax is often of great relief in pleurodynia. Each strip of plaster should extend about 3 inches (7.5 cm.) beyond the mid-line on both back and front. The rest, especially in affections of the shoulder, should not be too prolonged for stiffness of the joint and even ankylosis may result. Dry heat applied by means of the hot water bag or by rubbing the affected part with a hot flat iron, a layer of flannel being interposed, is often effectual in relieving the pain. Hot poultices may also be used and baths of steam may be employed. Recently hot-air apparatus has been specially constructed so that it is possible to bake any part of the body and the application of hot air by this means is an excellent method of treatment; upon the same principles a Turkish bath may cut short an attack. The application of the high frequency electric current is perhaps more effective than any of the foregoing methods and when followed by vibration massage, when this can be borne, is highly to be recommended. It is difficult to explain the action of the current but possibly it so affects the nutrition of the muscle cells, or the nerves, if muscular rheumatism is a nerve disorder, as to bring about a more normal state; certain it is however that many instances, particularly of chronic lumbago, may be greatly benefited by its application. The thermo-cautery is also useful, blisters and cups have a field of usefulness and, for very severe pain, we may have recourse to acupuncture, several heavy needles being plunged into the painful muscles and allowed to remain for two or three minutes. The hypodermatic use of morphine may become necessary.

Liniments may be employed but it is probable that the benefit derived is due quite as much to the accompanying friction as to the medicament.

With regard to internal treatment it may be said that in a certain number of instances the administration of the salicylates may cause benefit, certainly a judicious trial will do no harm. For the pain antipyrine salicylate (salipyrine) in 10 grain (0.66) doses given every hour for 4 or 5 doses

and then at longer intervals is often effective, and, empirically, good results often follow the administration of ammonium chloride, 10 to 20 grains (0.66 to 1.33) every 1 to 2 hours up to the limit of the stomach's toleration; this latter drug is especially effectual in lumbago and stiff neck.

Persons subject to successive attacks should dress warmly and avoid overheating and exposure of all descriptions. Their diet should be nutritious and non-irritating and tonics, such as codliver oil, iron, arsenic and strychnine, should be prescribed if indicated and the iodides, nux vomica, sulphur or guaiac may be given in the attempt to combat the chronic myalgic tendency. Purinæmic patients should be treated in accordance with the suggestions offered under the section devoted to the management of this condition.

ARTHRITIS DEFORMANS.

Synonyms. Rheumatoid Arthritis; Osteoarthritis.

Definition. A chronic joint disease characterized by the occurrence of changes in the intra- and peri-articular structures, by atrophy of the bony structures or the development of osseous growths interfering with the joint function.

Ætiology. This affection seems to be rather more common in females than in males and those whose occupations render it necessary that the hands should be much in water and thus subject to sudden and frequent changes of temperature, as well as those who are sterile or subject to uterine or ovarian disorders, appear to be predisposed to the disease. Heredity likewise has probably an ætiological significance. The incipience of arthritis deformans usually takes place during the third decade of life but exceptionally the disease may begin as early as 12 or as late as 50 years of age.

The monarticular type of the affection is probably a disease of the central nervous system and its lesions are the result of trophic changes.

The polyarticular type has of late been attributed to infection with some as yet undiscovered micro-organism. While bacteria have been isolated from the joint lesions their specificity remains to be proven.

Pathology. There are three varieties of arthritis deformans: *a*. The symmetrical type in which both upper extremities are involved. *b*. The unilateral form in which the hand and foot of the same side are affected. *c*. The monarticular type which involves a single joint and which is due to a lesion of the central nervous system.

The study of the joint in this disease by means of the X-ray shows that in certain instances the changes chiefly involve the intra- and peri-articular structures, the former being thickened and their fringes hypertrophied and the latter swollen and infiltrated; fluid may be present in the bursal and articular

cavities. In other subjects the changes involve principally the cartilages and bones; the former soften, become thin and may become wholly absorbed, leaving the joint surfaces bare and eburnated, atrophy of the shafts may take place and nodules of bone develop at the edges of the articulations. In still a third class of patients there is bony hypertrophy; this is particularly prone to occur when the spinal column is involved and may result in ankylosis, a manifestation which is rarely met in other articulations as a consequence of this affection.

Secondary trophic changes and neuritis are not uncommon; muscular atrophy, contractures and even disintegration of the ligaments with resulting dislocation (Charcot's disease) of the joints may be observed. The extremities are deformed, the hands being often deflected to the ulnar side.

Symptoms. In the type in which the involvement is *polyarticular*, nodules (*Heberden's nodes*) develop gradually upon the lateral aspects of the terminal phalanges, more particularly of those of the hands; at the beginning of this manifestation signs of acute inflammation, swelling, pain, redness and tenderness, may be present, and these symptoms may appear at intervals during the course of the disease without assignable cause or as a sequence of dietetic errors. These enlargements may be mistaken for gouty tophi but are wholly different both in causation and composition. The joint cartilages soften and the articular extremities of the bones become bare and hard. Patients in whom the disease is evidenced by the development of these nodosities are likely to escape involvement of the larger joints and are believed to be likely to enjoy long life.

In polyarticular arthritis deformans of the *progressive type* the manifestations may be either acute or chronic. The former variety occurs especially in females in the third decade of life and in association with frequent pregnancies and lactation; it may also appear in children and at the climacteric. The attack is characterized by polyarticular swelling and tenderness and a febrile movement; the symptoms persist, it may be with remissions, until ultimately the permanent joint changes result.

The chronic variety is usually symmetrical, and gradual in onset with pain and swelling, although an acute attack may appear intercurrently. Frequently one pair of joints after another becomes involved until the patient is wholly disabled, although quite frequently the finger joints are unaffected. The articulations may become fixed in flexion, especially those of the knees and hips, and muscular contractions are common; with these there is an atrophy which renders the articular enlargements more apparent; while the joint cavity may contain fluid it is more often dry, motion being difficult and attended with crepitus. True bony ankylosis does not occur but the immobility is due to peri-articular thickening, adhesions between the articular cartilages and the presence of bony outgrowths. The presence of pain is not constant,

in certain instances it may be very severe, especially at night, while in other subjects the disease may develop with comparatively little discomfort. Pain on motion is the rule. Tingling and numbness of the extremities, cutaneous pigmentation and glossiness of the skin over the joints are not rare. The affection is likely to progress, accompanied by increasing weakness and anæmia, until the patient is quite disabled, although at times a stationary period may be reached and continue, the patient suffering no pain and the general health remaining good, the only inconvenience being the permanent disability. Complications are not common but coincident dyspepsia and anæmia, during the active stage of the disease's development are frequent.

The monarticular type of arthritis deformans is observed most frequently in old men and involves especially the hip, the knee, the shoulder or the joints of the vertebræ; a history of traumatism is not rare. In the hip the condition has been termed *morbus coxæ*. There is wasting of the muscles around the affected joint and in this respect as in others the lesions are quite the same as those occurring in the polyarticular type; indeed in certain instances the other joints may not be entirely unaffected, the corresponding articulation of the opposite side frequently showing changes of minor degree.

The vertebral type is characterized by a gradual progressive vertebral ankylosis (*spondylitis deformans*). It occurs in two types; in the one the vertebral articulations only are affected, with associated nerve symptoms, such as pain, muscular atrophy, loss of sensation and ascending degeneration of the cord; in the other the nervous manifestations are less marked and there may be accompanying affection of the hip or shoulder joints. It would seem that these two forms of this type of arthritis deformans might better be merged in one as there is little reason for their separation. The condition may begin in any part of the vertebral column and at times affects the cervical region alone. It has been thought to start as a meningitis which by exerting pressure upon the nerve roots leads to paralysis of the spinal muscles and ultimate ankylosis of the spine.

In children arthritis deformans is a very interesting condition, it appears before the second dentition with fever in acute instances but with merely joint swelling and stiffness in those of subacute type. All the joints, including those of the vertebræ, may be affected and there are often enlargements of the cervical and other lymph glands and of the spleen. Culture and inoculation experiments in this form of the disease have failed to reveal any evidence of tuberculosis.

The diagnosis usually offers no difficulty, although in subjects who present an onset with fever the condition may be mistaken for acute articular rheumatism, but in the latter there is a tendency to successive joint involvement. The absence of tophi will distinguish arthritis deformans from chronic gout but the differentiation of the disease in its late stages from chronic rheumatism

is difficult, in fact the affection is considered by some as an advanced form of this latter disorder.

The prognosis as regards cure is distinctly unfavorable but the disease in no way interferes with the continuance of life.

Treatment. For the patients in whom the onset is acute and resembles that of acute articular rheumatism a treatment, external and internal, similar to that of the latter disease should be prescribed. Of the chronic stage the internal treatment should be calculated to improve nutrition in every way possible and, while we may not be able to influence the course of the affection in any great measure, we can accomplish something and the patient may be encouraged with the hope that the progress of the disease may stop at any time, also with the fact that periods of remission in its development may occur. The tonics, especially iron and iodine, are indicated and the judicious administration of arsenic is to be recommended. Iron may be prescribed in the form of the sulphate or, if this causes gastric disturbance, iron vitellin in half-ounce doses (15.0) will prove an excellent substitute. Iodine may be given with iron in the form of syrup of iron iodide or separately as syrup of hydriodic acid of which 1 drachm (4.0) should be taken ½ hour before each meal in a wineglass (60.0) of water. A 10 percent. solution of iodine in oil of sesame may also prove beneficial; of this 10 to 20 drops (0.66 to 1.33) may be given every 3 hours. Iodine is particularly useful when there is tendency to peri-articular thickening and it is probable that its administration in either of the forms above suggested will effect more benefit than will potassium iodide; this last, however, may be employed if desired. In the improvement of the general nutrition codliver oil is an excellent adjunct to the patient's diet which should be as generous as possible. The regimen should not be restricted except in so far as to eliminate indigestible and irritant foods. The bowels should be kept freely open.

Exercise, when practicable, should be advised and should be taken, if possible in the out-door air. Unfortunately, in many instances, the nature of the disease prevents systematic out-door exercise and it is here that massage will prove extremely useful; by its employment we successfully combat the tendency to stiffness of the joints, prevent in some measure the muscular atrophy and diminish the infiltration about the articulations.

Of other physical methods the treatment by means of the application of hot dry air—the so-called baking process—will benefit many patients and should always be tried even though in a certain number of instances it will probably be found ineffective.

Electricity in the form of the continuous constant current (galvanism) is useful in diminishing the pain and is often otherwise beneficial, and the electric bath, beginning with a rather weak current, may be employed. Static electricity properly administered is often of great benefit.

Spa treatment and the hydrotherapeutic measures that accompany it may afford some relief. Hot baths of water, air or steam are best but should be taken tentatively at first, for some patients are made worse by their employment, probably owing to their depressing influence upon nutrition, particularly when they are taken in connection with diet restriction. It must be remembered that a full diet is one of the essentials in the treatment of this disease. Hydrotherapy at home is often practicable and hot-air baths may also be taken in the patient's own house. Hot sand or mud baths are often beneficial; the former may be conveniently taken at home. The application to the painful joints of hot wet or dry compresses is frequently effective in lessening the pain, as also may be the application of the actual cautery.

Orthopædic surgery has a field of usefulness in the treatment of this disease, particularly in the patients with spinal involvement, the acute stage of which may be greatly benefited by means of immobilization with the plaster of Paris jacket. The breaking up of the joint adhesions under anæsthesia is sometimes indicated.

OBESITY.

Synonym. Corpulence.

Definition. An abnormal accumulation of fat in the tissues of the body.

Ætiology. Obesity occurs in numerous instances as a result of hereditary influence; it usually does not appear until after middle life but is sometimes seen in children in whom it is met as a result of improper feeding. In these subjects it is often associated with rickets. While many corpulent persons enjoy excellent general health a superabundance of fat is frequently observed in chlorotic girls. Obesity by no means signifies that the sufferer is an excessive eater for it is a notable fact that many fat persons are abstemious in this regard, perhaps not so much as a result of self-denial as of lack of appetite.

Gout is an ætiological factor which is not to be neglected but the most important cause is the association of over-eating and too little muscular exercise. Women, possibly because of their greater proneness to a sedentary mode of life, seem to be more subject to obesity than men. The excessive use of alcoholic drinks, especially the malt beverages, has a direct influence in the production of this condition. The tendency of obesity to appear after the menopause and with the decline of sexual activity in the male would seem to show that sexual indulgence lessens the predisposition to its occurrence.

Fat may be derived from any one of the three classes of food and usually obese persons are those who eat largely of carbohydrates, fats and proteids, the carbohydrates, in the light of our present knowledge, being less responsible for fat production than was formerly believed.

Symptoms. These, in the corpulent subject who is otherwise in good health, consist merely of the familiar appearance, large round visage, multiple

chin, great girth, etc., which one sees so frequently. As the obesity increases, dyspnœa and the symptoms due to fatty infiltration of the heart muscle and arteriosclerosis, such as weak heart action and tendency to venous congestion with œdema, appear.

Enlargement of the liver, due to fatty degeneration of the organ, is common and digestive disorders are frequent. Women often suffer from gynæcological complaints and the occurrence of intertrigo where, as a result of the excessive development of fatty tissue, two skin surfaces come into contact, as in the groins, about the labia and under the breasts, is often observed.

Treatment. Prevention is necessary in subjects who show hereditary or other tendency to become corpulent; these should be advised against overeating and the starches and fats in the dietary should be diminished. Exercise in the fresh air should be systematically prescribed; cool baths are a necessary adjunct to the other measures if the patient's reaction is satisfactory.

Various dietetic treatments have been exploited most of which bear the names of their originators. Of these it must be said that no stated method is applicable to every instance of the disease but each patient should be managed in accordance with the existing indications. Perhaps the best known system is that of Banting which consists in the elimination from the diet of carbohydrates and fats and allowing considerable amounts of proteid food in the form of lean meat; green vegetables are also permitted. Water and alcoholic drinks are not forbidden.

Ebstein's dietary restricts the quantity of food ingested but allows fats and carbohydrates in considerable amount, sweets and potatoes, however, are forbidden.

Oertel's system insists upon a diminution of the ingested fluids, only a pint (500.0) or slightly more, of water being allowed; fat is permitted in moderate amount but not so freely as by Ebstein while the proteids and carbohydrates are less restricted than by this clinician. The fluids are restricted on the ground that they increase any circulatory difficulty which may be present.

The following table gives certain dietaries expressed approximately, compared with the generally accepted requirements of an average adult at moderate work; the solid constituents are reckoned as being free from water.

Dietary.	Proteids.	Fats.	Carbohydrates.	Caloric Value.	Fluid as Beverage.
	oz.	oz.	oz.		Pts.
Normal - - -	3½ (105.0)	3 (90.0)	14 (420.0)	3,000	3-4 (1,500-2,000)
Harvey-Banting	6 (180.0)	⅓ (10.0)	2½ (75.0)	1,100	2 (1,000)
Oertel - - - -	5½-6½ (165.0-195.0)	1-1½ (30.0-45 0)	2½-3½ (75.0-105.0)	1,200-1,600	1-1½ (500-750)
Ebstein - - -	3½ (105.0)	3 (90.0)	1¾ (52.0)	1,300	3 (1,500)
Von Noorden -	5½ (165.0)	1 (30.0)	3½ (105.0)	1,350	2 (1,000)

Dujardin-Beaumetz recommends the following regimen: Breakfast at 7 A. M. to consist of 6¼ drachms (25.0) of bread; 12½ drachms (50.0) of cold meat without fat and 6 ounces (180.0) of weak tea. Luncheon at noon consisting of 12½ drachms (50.0) of bread, the crust being preferable to the soft part; 3 ounces (90.0) of meat or two eggs; 3 ounces (90.0) of green vegetables; a salad; 3 drachms (12.0) of cheese and, for dessert, cooked fruit of any desired variety. Dinner at 7 P. M. No soup; 12½ drachms (50.0) of dry bread; 3 ounces (90.0) of meat and vegetables, salad, cheese and fruit as at luncheon. The fluids are reduced and pastry and sweets are forbidden. Starches are cut down to a minimum and the only alcohol allowed is half a glass of a light white wine with the two principal meals. Alkaline waters are also permitted and the patient may take a small sup of black coffee after dinner. Still better than to take fluids with the meals is to omit them at these times and to drink about two hours after eating a glass of white wine mixed with two parts of water, or, if preferred, a large cup of weak tea without sugar. With some patients it may be more advantageous to give small quantities of proper food in the intervals of the meals lest the reduction of the diet produce weakness. The importance of institutional treatment in connection with diet regulation cannot be over-rated, for the systematic exercise, bathing, etc., that can be carried on at a hospital or sanatorium are very essential adjuncts to the successful management of patients suffering from obesity.

The oxidation of the fats of the body may be accelerated by stimulation of the skin by means of massage although in some instances this procedure is not successful in reducing flesh. Hydrotherapeutic measures are also indicated, cold fresh or sea baths being preferable for some patients while others are more satisfactorily treated if Turkish and steam baths are prescribed; the latter should be followed by douches and massage.

Obese subjects should, when possible, take regular muscular exercises such as walking, bicycling, horseback riding or gymnastics.

Too much sleep predisposes to corpulence and most patients will do well to limit their slumber to six, or at most eight hours.

It is often wise to stimulate the liver, which in many instances is sluggish in its action; this may be accomplished by prescribing Carlsbad or Kissingen salts or even sodium or magnesium sulphate.

The spa treatment, as carried on at Carlsbad, Marienbad and other like resorts, is often successful in reducing the weight of over-fat subjects and many such, after a few weeks' sojourn, will exhibit marked improvement evidenced by amelioration of the unpleasant symptoms of the obesity as well as by loss of body weight. This is probably the result of the systematic and regular mode of life combined with the use of laxative waters and a reduced diet. The management of obesity by means of a few weeks' stay at a resort, while, during the rest of the year the patient regulates his habits to suit him-

self, is far less to be recommended than a slow and continuous method of treatment.

The administration of thyroid extract in conditions of obesity has come into vogue during recent years and it may bring about a loss of weight in certain instances in which, perhaps, the corpulence is the result of disordered function of the thyroid gland. The dried extract is the preparation to be preferred and its usual dose for an adult is from 3 to 5 grains (0.2 to 0.33) three times daily. It is not, however, a drug to be carelessly used and its effects should be watched (see the treatment of myxœdema).

The administration of iodine with the alkaline iodides has also been suggested and these may be prescribed in the following formula. Metallic iodine 1½ grains (0.1), potassium iodide 22½ grains (1.5), water to 1 ounce (30.0); of this a teaspoonful should be taken 3 to 4 times a day. The alkaline salts of lithium, potassium and sodium may also be given thus: potassium carbonate 1½ parts; lithium carbonate 2 parts; sodium bicarbonate and potassium iodide of each 6 parts; water to 300 parts; the dose of the mixture being 2 to 3 dessertspoonsful (8.0 to 12.0) daily.

SCURVY.

Synonym. Scorbutus.

Definition. A disease characterized by anæmia, general weakness, a spongy condition of the gums and a tendency to hæmorrhages from the skin and mucous membranes.

Ætiology. Formerly scurvy was very common among sailors upon long voyages where it was impossible to arrange a dietary containing fresh vegetables and from this fact the incidence of the disease was considered to be due to the lack of these articles of food, particularly, as with the better methods of preserving food and with the quicker voyages which are in evidence today, the affection has all but disappeared. However, since it has been shown that scurvy occurs epidemically, endemically and sporadically, independently of dietetic conditions, and that it may not appear when nothing but meat is eaten for months at a time, the theory that the disease is due to a lack of vegetable elements in the food has been greatly shaken. That it may appear as a result of a diet from which vegetables are wholly or in part absent is probable unless a large number of reported instances in individuals who have subsisted for considerable periods upon such articles as meat, bread, tea and coffee have been coincidences.

Certain observers have attributed scurvy to the deficiency in the diet of the potassium salts and others to the lack of the alkaline carbonates derived from the vegetable acids.

Another theory of the causation of the disease is that it results from some

toxic substance produced by the decomposition of food. This hypothesis is supported by the fact that an affection analogous to scurvy has been induced in apes by feeding them upon slightly decayed food.

A third view of the ætiology of scorbutus is that it is an infection and due to a micro-organism which is as yet not isolated. A bacterium has been found occurring in instances of the disease which, when cultivated and inoculated into lower animals, causes symptoms and lesions resembling those of scurvy; the relation of this organism to the disease is not yet definitely proven.

As predisposing causes we may mention over-crowding under unhygienic conditions, such as obtain on ships, in army camps, asylums, etc., exposure to cold and wet, and mental and physical over-work. The principal factor is, however, the eating of improper food for a considerable period.

Pathology. The changes in the blood are not characteristic of anything more than marked anæmia; there is no increase in the number of leucocytes. The blood itself is dark and fluid. Hæmorrhages in any part of the body may be observed; into the skin, mucous membranes, muscles or other tissues; they may take place even into the joints. Bleeding into the liver, kidneys and muscles may be accompanied by degenerative changes. The spleen is enlarged and softened and there is swelling of the gums, in some instances so pronounced that the teeth fall.

Symptoms. The onset is usually gradual with increasing emaciation and weakness; the skin is pale, the tissues about the eyes are swollen and bluish. Dyspnœa on exertion with palpitation may be present and the patient may complain of muscular and joint pains. The gums become soft, swollen and spongy, they bleed easily, may be ulcerated and the teeth may become loose and drop out. The breath is foul and the tongue red and swollen; rarely there may be necrosis of the jaw.

Petechial hæmorrhages are noticed, first upon the legs, later upon the upper limbs and body. As the disease progresses the hæmorrhages become larger; they are dark red, rounded, and, when directly under the skin, may cause circumscribed tumors. They are less common in the mucous membranes but may take place under the periosteum and into the serous membranes. Subperiosteal hæmorrhages, especially in the legs, may break down into sluggish sores. Bleeding results from the least traumatism; epistaxis is common but hæmaturia and bloody stools are less frequent; hæmoptysis and hæmatemesis are very seldom noted.

Œdema of the ankles is common and the urine may contain albumin. The patient suffers from weakness; mastication is painful and the appetite is poor. The bowels are usually constipated. The heart is irregular and feeble and the functional murmur of anæmia may be heard over the second left space close to the sternum. The temperature is seldom elevated. Hæmorrhagic infarcts of the lungs or spleen may occur.

Mental symptoms, such as depression and insomnia, are common; delirium is a late symptom; meningeal hæmorrhage, convulsions and paralyses have been observed, as have hemeralopia and nyctalopia.

The diagnosis is simple when a number of instances of the disease appear at the same time and place. The hæmorrhages and spongy condition of the gums are fairly characteristic and when these occur in connection with an improper diet and disappear when proper food is prescribed the diagnosis is assured.

The prognosis in the early stages is good but later the tendency to serious complications such as infarct, pleural or meningeal hæmorrhage, nephritis, etc., renders it less favorable.

Treatment. Prophylaxis consists in so regulating the supplies taken by ships on long voyages that there shall be a sufficient amount of fresh vegetable food; this has been done by law. Free ventilation and avoidance of dampness are to be advised.

The treatment of the disease is chiefly dietetic. The juice of two or three lemons or oranges should be taken daily, in connection with a regimen containing plenty of fresh meat and green vegetables, such as lettuce, water-cress, spinach, onions, cabbage, celery, etc., and will cause a rapid amelioration of all the symptoms. If the digestion is so impaired that careful feeding is necessary the fruit juices should be given together with milk, beef juice, scraped beef, gruels and other easily digestible foods until a tolerance for ordinary articles is established, when eggs, potatoes and the substances mentioned above may be gradually allowed. A sluggish digestion may be stimulated by giving the vegetable bitters, strychnine, quinine, etc., and it is often advisable to add iron in order to assist the regeneration of the blood. An excellent preparation is the elixir of strychnine, quinine and iron of the national formulary. Necessary adjuncts to treatment are moderate exercise, bathing and regulation of the general hygiene.

The various symptoms should be treated as they occur. For the gingivitis astringent and antiseptic mouth washes should be prescribed. Swabbing the gums with 2 percent. tannic acid or 5 percent. silver nitrate is an excellent measure. A saturated solution of potassium chlorate is serviceable if ulcers are present and potassium permanganate 1 to 5000 or Dobell's solution makes a useful mouth wash.

For the hæmorrhages surgical means should be employed when necessary, and the administration of calcium lactate or chloride in 20 grain (1.33) doses 3 times daily is a very effective measure in checking these manifestations, owing to the influence of these salts in increasing the rapidity of the coagulation of the blood. The injection of solutions of gelatin has also been suggested in hæmorrhage but is less to be depended upon than the administration of the calcium salts. The same may be said of other internal hæmostatics; these, however, may be used if desired.

The constipation may be controlled by means of intestinal irrigations.

Ulcerations upon the limbs require surgical treatment as does separation of the epiphyses which sometimes occurs.

The complications, cardiac, pulmonary, renal, etc., should be treated as when occurring independently.

INFANTILE SCURVY.

Synonym. Barlow's Disease.

Definition. A disease of infants analogous to scurvy as observed in adults and often associated with rickets.

Ætiology. Infantile scorbutus is due to improper feeding; in most instances the disease occurs between the 6th and the 15th month and it is often seen in the best class of private practice. Exactly what the cause of the affection is, it is at present impossible to state, we merely know that it is the result of a lack of something in the food which is essential to normal nutrition. The condition is most frequently observed in infants who have been fed upon proprietary foods, sterilized or condensed milk; it has also been reported in breast-fed babies. As a rule several months of improper feeding are necessary to the development of the disease.

Pathology. The most constant and characteristic lesions are hæmorrhages beneath the periosteum, especially that of the bones of the legs. Intermuscular and peri-articular extravasations may also be present. There may be epiphyseal separations in extreme instances of the disease; changes in the bones analogous to those of rickets may be observed. Hæmorrhages into the skin, mucous membranes, the serous sacs and the viscera are sometimes found.

Symptoms. The onset is usually gradual with loss of flesh, increasing paleness and fretfulness. Soon tenderness and pain upon motion of the limbs is noticed; at first this is observed only when the child is handled, later it becomes constant; swelling above the ankles may be present. The gums are swollen, spongy and tend to bleed upon irritation or even spontaneously, they are purplish in color and may obscure the teeth. Ecchymoses in the neighborhood of the large joints may appear. The increasing muscular weakness may be mistaken for paralysis. Ultimately the patient becomes anæmic, cachectic and emaciated; hæmatemesis, melæna or hæmaturia may occur and late in the disease there may be a slight febrile movement; exophthalmos due to orbital hæmorrhage may be noted. Epiphyseal separations are late symptoms and usually result from trauma. Albuminuria with casts is not infrequent and most scorbutic children suffer from gastric and intestinal derangement.

The diagnosis. Infantile scurvy may be differentiated from rheumatism

by the age of the patient, the condition of the gums and the history of the dietary, and from poliomyelitis by the pain and tenderness.

The prognosis, when the disease is recognized early in its course, is good, the recovery under treatment being very rapid; only very rarely are permanent lesions left behind. Unrecognized instances may terminate fatally in three to four months from cachexia, heart failure or intercurrent disease

Treatment. The patient should be immediately put upon cow's milk properly modified in accordance with its age and digestive ability. In addition fresh fruit juice, preferably that of the orange, should be prescribed; this should be given about half an hour before feeding and in total daily quantity of ½ ounce to 4 ounces (15.0 to 120.0) depending upon the age and tolerance of the child. Even when diarrhœa is present the fruit juice is not always contraindicated, this manifestation often being a symptom of the scurvy and one which becomes rapidly ameliorated under this treatment. The expressed juice of fresh beef may also be given, and, if the patient is of proper age, fresh vegetables are valuable adjuncts to treatment.

The anæmia and poor general condition often render advisable the administration of codliver oil, the syrup of iron iodide, and other tonics; these should seldom be prescribed before the scorbutic symptoms have disappeared.

Epiphyseal separation necessitates orthopædic treatment in connection with the measures above suggested. Fortunately the separations are seldom permanent.

RICKETS.

Synonym. Rhachitis.

Definition. A disease of infantile nutrition characterized chiefly by anomalies in the development of the bones and consequent deformities.

Ætiology. Rarely the affection is congenital. It occurs far more frequently in cities than in the country and is more common in Europe than in America. It is particularly frequent in the Italians and negroes of the United States, probably because the native habitat of these races offers a warmer climate than ours. It occurs especially amongst the children of the poorer classes because of the vitiated hygienic conditions in which these unfortunates are compelled to exist. In Russia it is said to appear commonly in the families of the well-to-do, the climate of this country, in its northern part at least, being such as to render free ventilation uncomfortable. Dense crowding and lack of sunlight seem to be important predisposing causes. An unsuitable or insufficient diet is the most essential ætiological factor and consequently the disease is more often observed in artificially fed infants than in those fed from the breast; it does, however, appear in breast-fed children when the milk is not of good quality and also when the child is not weaned at a proper time. Infants fed upon sterilized or condensed milk or upon proprietary

foods are especially prone to the affection which seems here to be due to a lack of sufficient fat and proteid matter in the dietary, in consequence of which there is for some reason a defective assimilation of the calcium salts.

Syphilis may co-exist with rickets but the latter is not a manifestation of the former disease although it may be modified by it.

Sex has nothing to do with the incidence of rickets; the disease usually shows itself between the 6th and 15th month but the so-called late rickets may not appear until the 10th or 12th year of life.

Pathology. The lesions are chiefly of the osseous system, particularly the bones of the cranium, the long bones and the ribs. The skull tends toward the cubical in shape, the vault and occiput being flattened while the frontal and parietal eminences become more pronounced. The head is enlarged and the forehead bulging. The closure of the fontanelles is delayed, even until the third year, the margins of the bones being thickened and soft. Foci of delayed ossification which yield to pressure may be present in the parietal or occipital regions.

The epiphyseal cartilages of the long bones are enlarged as a result of the rapid thickening of the zone of proliferation, which is bluish in color and soft and spongy. The periosteum is easily detachable, revealing a spongy bone markedly deficient in the lime salts. The bones bend easily, producing deformities which are particularly evident in the tibiæ as a result of the pressure of the body weight or are produced by sitting cross-legged. The femora also may be bowed outward or forward. The humerus is often bent and the radius and ulna may be twisted out of shape. Exaggeration of the normal curves of the clavicle is not infrequent.

The chest is characteristically deformed; a vertical groove may be present between the 4th and 8th ribs upon its lateral aspects producing the "chicken-breast." Accompanying this deformity the so-called Harrison's groove may be observed; this is a transverse depression extending from the xiphoid cartilage toward the axilla. The "rickety rosary" is also frequent. This term is applied to the bead-like nodules which appear at the junctions of the ribs with their cartilages.

Spinal curvatures are common, the normal dorsal convexity and the lumbar lordosis being accentuated. Scoliosis, also, is not rare. Thickening of the scapulæ and the well-known rhachitic deformity of the pelvis are often observed, the iliac bones being distorted, the antero-posterior diameter of the true pelvis diminished, and the pubic arch narrowed.

The bony deformities are due to the tension of the muscles or to the pressure of the body weight.

Upon chemical analysis the bones in rickets are found to contain a superabundance of organic matter and a greatly diminished proportion of the lime salts.

The muscles are small and poorly developed and the abdomen is usually enlarged and prominent. (Lucas's sign.)

Various lesions of the viscera are common. Collapse of the lung may be present beneath the lateral grooves of the thorax; bronchitis and bronchopneumonia are frequent and mild gastric and intestinal catarrh with dilatation may be observed. Splenic enlargement (simple hyperplasia) is often noted and the liver may be increased in size. Enlargements of the lymphatic glands often occur but are merely associated lesions.

Symptoms. Many of these have been dealt with in discussing the pathology of the disease. The onset is usually gradual and as a rule appears before the 15th month; one of the earliest symptoms is sweating of the head, especially at night and often so profuse as to wet the pillow; the child sleeps restlessly, and may exhibit a slight febrile movement and digestive disturbances such as nausea, regurgitation of food, flatulence and constipation. He is poorly nourished, dentition is delayed and the teeth, when they appear, are often poorly formed and decay quickly. Tetany and laryngismus stridulus are not infrequent and rickets is a very important predisposing cause of infantile convulsions, these being usually excited by some digestive disorder. Tenderness over the epiphyses may be present causing the child to cry when lifted or otherwise disturbed.

The first symptom to appear referable to the osseous system is the beading of the ribs and is a very constant manifestation. In very young infants as an early symptom soft spots may be observed over the occipital or parietal bones which crackle somewhat like parchment upon pressure. This condition is termed cranio-tabes and may occur in congenital syphilis both with and without rickets. The other bony deformities have been described in the section devoted to pathology. The fontanelles are late in closing, often persisting until the child is $2\frac{1}{2}$ years old, the forehead is protuberant and the face relatively small and of a prematurely aged expression; the veins of the scalp are often conspicuous and the hair over the occiput is thinned owing to the friction of the pillow.

The ligaments, especially those of the large joints, are loosened and stretched, causing the weak ankles, the backward bowed knees and the abnormal mobility of other articulations which are so often seen in rickets.

The muscles are flabby and small and their consequent weakness causes walking to be delayed and interferes also with standing and sitting upright. The lack of power in the ill-developed muscles may be so marked as to render the differentiation from a true paralysis impossible except by testing the reaction to electricity. The lack of muscular tone is also in great measure responsible for the prominent abdomen and the constipation.

Rhachitic children are usually fat but their flesh is not firm and they are anæmic; they frequently exhibit lymphatic enlargements, hypertrophied

tonsils and adenoids and fall an easy prey to any acute disease, being particularly prone to all affections of the mucous membranes of the respiratory or digestive tracts. The condition of the blood is not typical; anæmia is usually present in varying degrees and the leucocytes may or may not be increased in number.

The liver and spleen are often palpable either as a result of enlargement or of the downward pressure of the thoracic deformities.

The diagnosis is seldom difficult. Rickets is to be differentiated from syphilis by the facts that in the former disease the bone affections are at the epiphyses rather than in the extremities or shafts, that necrosis never occurs and that the enlargements are of the bones themselves, while in syphilis they appear rather like soft swellings over the bone. In scurvy there are the typical gum lesions and the hæmorrhages, and the various paralytic conditions may be separated from rickets with extreme muscular weakness by testing the electrical reactions, and the patellar reflexes and by studying the cerebral condition.

The spine of rickets is flexible, the curves are less acute than those of Pott's disease and disappear when the patient is laid flat. The other symptoms of rickets are present, and these, with the absence of the characteristic manifestations of tuberculous hip and congenital dislocation, render the differentiation of the former affection from the two latter conditions a simple matter.

The prognosis is favorable, rickets alone never resulting fatally. There is always danger that the child may fall a victim to complicating disease. The course is chronic, the symptoms often continuing for months. Their progress usually ceases at the age of about one and a half years probably because the diet by this time has become more general and the child is allowed more in the open air. Under proper treatment gradual improvement takes place. The health of the patient is not permanently impaired unless there is marked deformity of the chest, although the bowing and shortening of the legs may prevent him reaching normal stature.

Treatment. Rickets being to a great extent a preventable disease and due to improper feeding and unhygienic surroundings, the prophylaxis consists in the avoidance of these factors in the causation of the affection. When previous children have suffered from rickets those who follow are markedly predisposed to the affection and upon this account should be the more carefully guarded.

Treatment proper consists primarily in diet regulation. Breast-fed babies when rickety should be artificially fed with properly modified cow's milk unless a wet nurse whose milk is of normal composition is available. Older children who are able to take food other than milk should be given a diet consisting chiefly of proteids and fats, carbohydrates being excluded as far as possible;

milk, cream, beef juice, eggs, red meat and fresh fruit, either raw or stewed, should make up the greater part of the regimen. Farinaceous foods, and particularly the proprietary infant foods, should be interdicted.

Hygienic treatment is at least as important as diet regulation and often more difficult to arrange. Fresh air, sunshine and out-door life are absolutely essential, consequently city children should if possible be removed to the country, or, if this is impracticable, the patient should spend as much time as possible in the parks or upon the roof where oftentimes a sort of play-ground can be constructed. Free ventilation of living and sleeping rooms is essential and the mother may be assured that, if properly clothed and protected from draughts, the child will be in no danger if the window of the sleeping room is kept open. Flannel night drawers with feet, and warm coverings are to be advised and as a hardening measure a quick sponging with water at from 65° to 70° F. (18.5° to 21.5° C.) after the daily bath is excellent.

With regard to drugs it may be stated that codliver oil—which is a food as well as a drug—is our chief reliance. It may be given in doses of a drachm (4.0) or less, to ½ an ounce (15.0), 3 times a day unless it disturbs the stomach when it should be administered by inunction either pure or mixed with lanolin in the proportion of 1 to 3 or 4. In very hot weather it is often wise to temporarily discontinue this agent. Phosphorus has been much used in rhachitic conditions and may be given combined with olive or codliver oil in doses of $\frac{1}{200}$ to $\frac{1}{100}$ of a grain (0.0003 to 0.0006) 3 times a day after meals; larger doses may cause digestive disturbances. The following formula is a useful one: phosphorus $\frac{1}{8}$ grain (0.008), oil of sweet almond ½ ounce (15.0), acacia 2 drachms (8.0), syrup 2 drachms (8.0), distilled water to 4 ounces (120.0). Dose, 1 teaspoonful 3 times a day after meals. Lecithin may be substituted for phosphorus, its dosage being 1 to 2 grains (0.065 to 0.13) 3 times a day in codliver oil. Calcium has been prescribed in the hope that it would supply the lack of mineral matter in the bones but this hope is probably vain for it is believed that any lime taken into the organism in excess of that provided by the food is excreted through the alimentary tract. Calcium, however, has a certain tonic effect in some instances and may be exhibited as the following formulæ suggest. Calcium phosphate 75 grains (5.0), calcium carbonate 2½ drachms (10.0), milk sugar 3¾ drachms (15.0), to be divided into 30 powders of which 2 to 4 may be taken daily. Codliver oil, lime water and syrup of calcium lactophosphate equal parts; one teaspoonful 3 times a day.

Iron in the form of the syrup of the iodide may be prescribed in anæmic patients. Arsenic is also useful.

Upon the theory that the disease is the result of a disorder of the thymus gland the administration of the fresh calf thymus in dose of 15 grains (1.0) for each month of the age of the patient has been suggested, or, if desired,

thymus tablets may be substituted for the gland substance. Atropine in doses of $\frac{1}{5\,0\,0}$ of a grain (0.000012) for a child of 1 year will lessen the tendency to sweating.

In preventing the deformities it is necessary to avoid lifting the child as much as possible and to discourage any inclination on the part of the patient to support himself in the standing position; he should not be allowed even to sit up unless supported. The deformed chest may be brought nearer into normal shape by ordering systematic respiratory exercises and gymnastics, children even as young as 3 years may be taught simple calisthenics, and the use of the pneumatic chamber has been suggested. The tendency to spinal curvatures may be lessened by keeping the patient upon a hard bed without a pillow under the head, but, if necessary, a thin pad under the lumbar region, so that this part of the back shall be raised slightly higher than the shoulders and buttocks. Daily placing of the child in the prone position and over-correction of the deformity by lifting the buttocks, the lumbar region being held stationary meanwhile, is useful. In advanced instances orthopædic apparatus may become necessary. The curvatures of the legs may be corrected manually and, when slight, they may even be outgrown; the child should never be allowed to sit with the legs crossed beneath him or habitually in any position because of the tendency of the limbs toward deformity. Braces may become necessary but any treatment of this sort after the age of $2\frac{1}{2}$ years is usually futile on account of the firmness of the bones; osteotomy is necessary after this period but should usually be delayed until the child is at least 4 years old and the bones have become wholly hardened. Knock-knees, bowlegs and curvatures of the radius and ulna may be corrected by this operation. The flattened pelvis in women may necessitate Cæsarean section, pubiotomy or symphyseotomy during childbirth.

In the management of rickets it is necessary to remember that constitutional treatment should be undertaken as early as possible and that it is usually of little use to continue it after the beginning of the 18th or 20th month, for by this time the active stage of the disease is past and merely the results of the affection remain.

CHAPTER III.

THE INTOXICATIONS, INCLUDING THE EFFECTS OF EXPOSURE TO HIGH TEMPERATURES.

LEAD POISONING.

Synonyms. Plumbism; Saturnism.

Ætiology. This is a common condition and one of which the sources are numerous. The most important are: the use of soft water, carbonated waters and alcoholic drinks, especially beer, which have passed through lead pipes or have been stored in receptacles lined with lead; the occupations of painters (*colica pictonum*), plumbers, typesetters, gold miners, white lead workers, potters, glaziers (Devonshire colic), because the laborers do not employ ordinary cleanliness and neglect to wash the hands before eating; the use of lead hair dyes and face powders, biting leaded white thread, eating certain canned fruits (lead solder), sheet lead (tin foil) about tobacco or sweets, filling holes in millstones with lead, playing with tin (lead) soldiers by children, the use of lead carbonate on burns, of diachylon plaster as an abortifacient or of lead and opium pills in dysentery, lead bullets in the flesh, the use of white or red lead in the vulcanization of rubber, false-tooth plates of lead, and the use of baking powder adulterated with lead chromate to give buns an attractive yellow color; chronic plumbism has been attributed to all these factors.

Lead is, perhaps, the best example of a poison which is comparatively harmless when taken in a single large dose, but of which most minute doses, if taken for a sufficient period, result fatally.

The lead enters the organism through the skin, respiratory tract or the alimentary system; in most instances of poisoning the toxic substance has been chiefly taken in through the mouth. Elimination takes place through the skin, kidneys, intestinal tract, saliva and milk.

Pathology. Normally a small amount of lead is present in the body and it is not very unusual for minute traces of the metal to be excreted by the urine. In plumbism lead is demonstrable in the organs and tissues. The muscles are the seat of fatty and fibrous degeneration; the nerves are in a state of degenerative neuritis; sometimes fatty changes are also present. The ganglion cells of the anterior cornua of the cord may be in a condition of atrophy similar to that found in anterior poliomyelitis. In acute intoxication the lesions of intense entero-colitis may be found.

Symptoms. *Acute poisoning* is most frequently due to taking lead acetate, a very large amount of which is necessary to produce a fatal effect, particularly since a great part of that ingested is generally vomited. Gastro-intestinal symptoms such as salivation, thirst, dysphagia, abdominal pain, emesis and diarrhœa result and the vomitus consists of a whitish fluid containing curd-like matter; in consequence of the astringency of the lead the purging is less intense than that caused by other irritant poisons, constipation being sometimes observed. The stools may be blackish owing to the presence of lead sulphide and these and the vomitus may contain blood. These symptoms are followed by weakness, coldness of the extremities and collapse. After recovery the patient may suffer from chronic plumbism.

A subacute form of intoxication is sometimes observed in which, after a short exposure to the effects of the metal, the patient suffers from anæmia, acute neuritis and even epileptiform convulsions and delirium similar to that caused by alcohol.

Chronic poisoning, it is said, may sometimes be detected by painting the skin with ammonium sulphide or sodium thiosulphate; three or four coats should be applied to a patch of skin several inches square and in the presence of plumbism this area will turn dark in about 24 hours as a result of the formation of lead sulphide. The presence of lead is also demonstrable in the urine. In the form of the sulphide lead is sometimes deposited upon the edge of the gums producing the characteristic "lead line," this is black in color and due to the presence of hydrogen sulphide produced by the action of bacteria (Burton's sign); if the teeth are sound and kept clean this manifestation is usually absent. The line is also observed in some instances at the junction of the anal mucous membrane with the skin.

The most prominent of the peripheral nerve effects of plumbism is *lead colic*, a phenomenon which is due to violent contraction of the intestinal muscles, probably resulting from stimulation of the nerve endings. As it is greatly relieved by the nitrites and other vaso-dilators it may be inferred that a primary vaso-constriction is one of its causes. With the colic the intestinal spasm forces the blood from the splanchnic area and the general blood pressure is raised, the pulse being slowed and rendered hard and tense. The pain, which is extreme and grinding in character, is chiefly located in the umbilical region, and the abdomen is retracted and hard; paroxysms of the most acute agony are often succeeded by intervals of comparative ease. The colic is usually preceded by constipation and may be accompanied by vomiting. The paroxysms may last for several days or a week, and then disappear to recur at intervals.

Other nervous symptoms apparently of peripheral origin are anæsthesia of various parts, lasting perhaps one or two weeks, and lead arthralgia, which consists of sharp lancinating or boring pain in the joints, bones, or the

muscles about the joints; this latter usually appears and disappears quite suddenly; the wrist may be swollen (Gubler's sign). Neuralgias are sometimes observed; these may be of central origin or due to peripheral neuritis. Lead amblyopia is a rare phenomenon; the sight may be lost entirely or merely somewhat impaired. This manifestation may be due to optic neuritis, which, if allowed to continue, leads to atrophy of the nerve, to uræmia with effusion into the optic sheath or to albuminuric retinitis.

In what is termed *encephalopathia saturnalis* the disorders observed are for the most part of cerebral origin, although the lower portions of the central nervous system are also involved at times. The cortex is chiefly affected and an irritation is produced which is followed by paralyses, both sensory and motor, although the latter are the more pronounced. There are usually muscular contractures and later choreic movements. Sometimes convulsions occur as a result of uræmia due to the nephritis which invariably follows chronic plumbism, sometimes they are due to the lead itself. The motor stimulation is ultimately followed by paralysis. In addition there is delirium, succeeded by depression and coma which latter may be uræmic. On the motor system the effects produced by the lead are neuritis, paralysis and atrophy. The usual site of the lesion is probably in the peripheral nerves and muscle cells, though in certain instances the central nervous system seems to be involved. A common characteristic of lead poisoning is the "*drop-wrist*" or "*painter's palsy*," which is probably attributable in part to paralysis of the extensor muscles and partly to the active contracture of the opposing flexors. A characteristic of lead palsy is that the supinator longus is not involved and the electrical response of the affected muscles is less than in other types of peripheral neuritis.

The patient afflicted with chronic plumbism is always anæmic; this condition of the blood is at first due to the constriction of the peripheral vessels and later to diminution of the hæmoglobin and red corpuscles in the blood. There is granular basophilic degeneration in many of the red cells and the presence of this condition is of some diagnostic value. Nucleated red cells are often found even if the anæmia is not of severe grade. Jaundice may result from the breaking up of red corpuscles and the liberation of large amounts of hæmoglobin. The leucocytes are often increased in number.

The results of lead intoxication upon the circulatory system consist in the production of arteriosclerosis which is early evidenced by a high tension of the pulse and an accentuation of the 2d aortic sound. These manifestations may be demonstrable before either colic or palsy is observed. Cardiac hypertrophy is common and the wall of the organ may be in a state of fatty or fibrous degeneration.

In the kidneys lead causes marked irritation in the process of its elimination, consequently nephritis is frequent in instances of acute poisoning

and is uniformly found in chronic plumbism both as a result of this irritation and of the arteriosclerosis induced by the presence of lead in the organism.

A remarkable circumstance in connection with lead poisoning is the frequency of gout in its subjects; this coincidence is much more common in England than in America. In districts where the ordinary type of gout is rare it is said that the disease is seldom induced by lead.

The prognosis depends upon the degree of the intoxication; it is favorable in early instances. Atrophic paralysis is likely to prove difficult of cure and the mental symptoms of lead encephalopathy may be permanent. The arterial lesions and those of the viscera which are evidenced by degenerative changes are usually incurable.

Treatment. Prophylaxis is of the greatest importance and the public should be more fully instructed concerning the dangers of lead. Special precautions are required in lead works, paint factories and in exposed trades. Dust should be avoided as much as possible, and, where this is necessarily present, thorough ventilation is an absolute essential. The necessity of frequent bathing and thorough washing before eating cannot be too strongly impressed upon the workman. The addition to the bath of sodium hypochlorite or potassa sulphurata has been suggested upon the ground that the sulphur neutralizes the lead by forming insoluble compounds with it. Food should not be permitted upon the premises and the clothing should be changed before leaving the works. The systematic use of milk in large amounts as a food is to be recommended. Sulphuric acid lemonade is generally employed as a prophylactic but is not particularly reliable. Weak or anæmic individuals should not be employed as workers in lead and it is advisable that women should be altogether excluded from such occupations.

In treatment the first indication is to remove the patient from the danger of further poisoning. In general, reliance is placed upon potassium iodide, saline purgatives, diuretics and the use of hot baths and massage to promote elimination, and upon the employment of appropriate measures to improve the patient's nutrition and strength. Potassium iodide is in universal use and appears to have a beneficial effect though the manner of its action is not clearly understood. It has been supposed to accelerate elimination through the kidneys, but it has recently been denied that the drug has any influence upon excretion by the urine or by the intestinal tract through which most of the lead escapes from the body. Baths of sulphurated potassium are efficient, especially if the patient is well soaped afterward and then thoroughly rinsed and rubbed with a rough towel. For the colic opium or morphine is often necessary, alum in 2 grain (0.13) doses is of great service and dilute sulphuric acid is also useful. The constipation may be relieved by a combination of magnesium sulphate and dilute sulphuric acid and the lead cachexia is greatly benefited by the latter, given in connection with quinine and ferrous

sulphate. In certain instances of chronic plumbism cathartics fail to act unless morphine is given to overcome the intestinal inhibition produced by the irritation resulting from the lead. Opiates may also be required for the relief of the joint pains. For the paralyses strychnine may be administered but our chief reliance is placed upon electricity and massage (see the section upon the treatment of multiple neuritis). If the muscles contract in response to the faradic current this should be employed, but if not the galvanic current should be used. Nephritis and gout due to lead intoxication should be treated in the same way as when resulting from other causes and the cerebral symptoms must be dealt with according to the special manifestations which present themselves.

ARSENICAL POISONING.

Acute arsenic poisoning as a result of the ingestion of Paris green, or of one of the various rat or vermin poisons which contain this substance (cupric arsenite), is common.

Symptoms. These as well as the pathology of the condition closely resemble those of Asiatic cholera. Large doses often cause no distress for a considerable period, but, within a half hour or perhaps longer, the patient experiences dysphagia with a sense of faucial constriction. Epigastric pain, quickly becoming extreme and general over the abdomen, follows; with it are associated nausea and excessive emesis and later there is profuse watery diarrhœa with tenesmus and thirst. The vomitus and stools may contain blood and there are muscular cramps, headache and dizziness; collapse ensues, with coldness of the extremities, pallor, small, feeble pulse and sighing respiration. Coma follows, and death, sometimes preceded by convulsions, takes place. Rarely the only symptoms noted have been collapse and coma. Death may occur within 24 hours but usually the patient lingers for several days. If recovery takes place the symptoms of chronic arsenic poisoning may develop.

Treatment consists in immediately emptying the stomach by lavage or by emetics such as zinc sulphate, 20 to 30 grains (1.33 to 2.0) or a tablespoonful of mustard to a tumbler of warm water. After the gastric contents have been removed the organ should be repeatedly washed with warm water on account of the insolubility of the arsenic. At the same time large amounts of freshly prepared ferric hydroxide with magnesium oxide or dialyzed iron, one ounce (30.0) should be given. The former mixture may be prepared by using 150 grains (10.0) of magnesium oxide to which is added sufficient water to make a thin magma which is slowly poured into a solution consisting of ferric sulphate, 10 drachms (40.0) and water, 4 ounces (120.0); the product is then shaken until a smooth mixture results. If either of these antidotes is

unobtainable light magnesia mixed with water may be substituted. The antidote must be repeated at intervals as long as acute symptoms persist. If neither magnesia nor the iron preparations are available, dependence may be placed upon large doses of castor oil and water. The collapse should be combated by means of subcutaneous injections of brandy or æther and warm applications should be made to the abdomen and extremities.

Chronic Poisoning. The medicinal administration of arsenic in too large doses may induce slight toxic symptoms such as abdominal pain, anorexia, nausea, indigestion, mild diarrhœa, puffiness of the eyelids, conjunctival injection and watering of the nose and eyes. Cutaneous eruptions are sometimes caused, and, while these may be in part a result of circulatory disorders, they are believed to be due chiefly to a direct action of the drug upon the skin. They may be erythematous, papular, vesicular or pustular and may be associated with a swelling resembling that of erysipelas. Prolonged administration of arsenic, it is said, may cause herpes zoster.

Arsenic is extensively used in the arts, especially in the manufacture of wall papers and fabrics, and consequently accidental poisoning among workers in arsenic is not rare; it may also occur in individuals who use articles containing the drug. The evidence regarding chronic poisoning from occupancy of rooms decorated with arsenical wall papers is contradictory but the facts favor its probability. Quite as often the poisoning is due to the arsenic which contaminates aniline dyes as it is to arsenical pigments, consequently chemical examination should be depended upon rather than color. Epidemic arsenic poisoning has occurred from the use of beer in the manufacture of which contaminated glucose has been employed.

Symptoms. In addition to the manifestations mentioned above, chronic arsenic poisoning is evidenced by a catarrhal condition of the nasal and pharyngeal mucous membranes, with sneezing and coughing; the various cutaneous eruptions appear and in some instances there is a pigmentation of the skin (arsenic melanosis); eventually the hair and nails fall. Enlargement of the liver with jaundice is sometimes observed and the later phases of the disorder are characterized by localized sensory and motor disturbances, chiefly in the hands and feet, resulting from polyneuritis. There are acute pain and sensations of formication in the extremities, followed by sensory paralyses with symptoms analogous to those of locomotor ataxia. These symptoms are followed by motor paralysis, as a rule confined to the limbs, but in some instances involving the trunk. The paralysis is usually symmetrical and the affected muscles, which are more often those of the extensor than flexor groups, become atrophied. Herpes zoster of the face or trunk is common. In very protracted instances the patient may sink into an apathetic semi-idiotic state or epilepsy may supervene. After death, in addition to the lesions in the digestive organs and nervous system, a condition of fatty

degeneration of the viscera, especially the liver, kidneys, stomach and heart, as well as of the muscles, is found.

A more full discussion of the nervous symptoms of chronic arsenical poisoning will be found in the section upon multiple peripheral neuritis.

Treatment consists in the discontinuance of arsenic if this is being administered, or if the condition is the result of arsenical surroundings, a removal from exposure. Elimination of the drug should be accelerated by means of laxatives, diuretics, diaphoretics, and the administration of potassium iodide. The treatment is otherwise symptomatic; the management of the paralyses will be discussed under the treatment of multiple peripheral neuritis. Tonics and plenty of nourishing and easily digestible food are indicated. Recovery usually takes place.

MERCURIAL POISONING.

Synonym. Mercurialism.

Acute mercury poisoning from corrosive sublimate or white precipitate is not unusual. Mercury bichloride in toxic dosage at once causes a metallic taste in the mouth, extreme pain in the pharynx and stomach, rapidly followed by intense retching and emesis. The vomitus soon becomes bloody and violent purging occurs, the stools being at first serous in character, later hæmorrhagic. The urine becomes scanty and contains albumin, casts and blood; the pulse becomes weak and rapid, the temperature falls below normal, all the vital energies are depressed and death may take place within a short time.

The *post mortem* lesions are usually those of a membranous colitis and a parenchymatous and hæmorrhagic nephritis, with general degeneration of the tubal epithelium; more rarely there is a peculiar deposit of calcium phosphate.

Treatment. The stomach should, if possible, be emptied immediately by means of the stomach tube, or, if this is not at hand, emesis should be provoked by faucial irritation, draughts of mustard and warm water or by the hypodermatic injection of apomorphine hydrochloride in dose of $\frac{1}{10}$ of a grain (0.006). Albumin in the form of the white of egg, that of one being sufficient antidote for 4 grains (0.24) of corrosive sublimate, the albuminate redissolving in an excess, or milk and flour should be given. Tannic acid is also useful since it protects the mucous membranes of the gastro-intestinal tract from the action of the drug.

Chronic mercury poisoning is less frequently observed than formerly when the administration of large doses of the drug was common. Workers in the metal are sometimes affected, the most profound instances of intoxication being due to the prolonged exposure to its fumes.

Symptoms. The first evidences of mercurialism are referable to the mouth. At first there is slight fœtor of the breath, later an unpleasant metallic taste and tenderness of the teeth when they are forcibly brought together are noted. These are followed by stomatitis, sponginess of the gums and salivation. If the ingestion of the mercury is continued the amount of saliva secreted becomes enormous; it is irritant and contains mercury. The breath becomes very foul, the gums are intensely inflamed, bleed at the lightest touch and are marked at the junction of the teeth by a dark red line. The teeth are loosened and may fall, the tongue and lips become involved in an obstinate inflammation which proceeds to ulceration, and, extending as gangrene to the cheeks, may produce frightful facial deformity. Even the maxillary bones may undergo necrosis. Nervous symptoms, such as tremors, erythism, and hallucinations, may appear and the faculties may be dulled. There is general muscular weakness and paralysis, with areas of partial anæsthesia, and joint pains may occur. The peripheral neuritis of chronic mercurialism is a much later manifestation than that of plumbism and even after the development of the palsies the muscles retain their irritability and do not undergo atrophy. The reflexes are usually unaffected; rarely they may be exaggerated. General nutrition is impaired and metabolism is profoundly affected, anæmia and marked cachexia resulting. With the cachexia the heart becomes weakened, the respiration rapid and shallow and the mentality impaired; the memory is imperfect, the temper irritable and melancholia and even mania may ensue. The special senses are affected as evidenced by deafness, dimness of sight and impairment of taste and sensation.

Treatment consists in acceleration of the elimination of the mercury through all possible channels. Elimination through the skin is favored by baths of sulphur and ordinary hot water and diuresis should be induced by causing the patient to drink as much water as can conveniently be borne and by the administration of diuretic drugs. Free evacuation of the bowels is necessary but if marked diarrhœa is present it may call for treatment by means of opiates and other remedies. The pain may necessitate the employment of opium. The common belief that potassium and sodium iodides have an effect in causing the elimination of the metal has been disputed but never disproven; at any rate the proper administration of these drugs can do no harm; care, however, should be taken that the doses are not too large, for the combination of iodine with mercury in the tissues produces a soluble salt which is very active and may, at times, cause secondary systemic mercurial poisoning. Belladonna is sometimes required to diminish the excessive secretion of saliva and in all instances a mouth wash of potassium chlorate solution is useful in the relief of the salivation and stomatitis; tincture of myrrh may be added to it and a mouth wash of tannic acid may also be employed. Careful attention should be given to the general hygiene and the cachexia should be com-

bated by plenty of nutritious food and such tonic and other remedies as may be indicated. The treatment in other regards is symptomatic; for the neuritis the methods and means of treatment suggested in the section upon multiple peripheral neuritis should be employed. Prophylactic means such as those indicated in the prevention of plumbism should be recommended in establishments where mercury is used.

ANTIMONIAL POISONING.

Acute antimonial poisoning resembles in its symptoms acute arsenical intoxication, the chief manifestations being those of intensely acute gastro-intestinal irritation. At autopsy the mucous membrane of the stomach and intestine is found in a state of hyperæmia and tumefaction; erosions and ecchymoses are usually present. There are often pustules in the mouth, œsophagus, stomach and small intestine and pulmonary congestion or inflammation may be demonstrable.

Treatment. The vomiting caused by the drug itself usually obviates the necessity for the employment of emetics but, if free emesis has not taken place, gastric lavage is indicated or apomorphine hydrochloride, $\frac{1}{10}$ of a grain (0.006) hypodermatically or zinc sulphate, 20 to 30 grains (1.33 to 2.0) by mouth should be administered. The bowels should be cleared of the poison in this situation by a purge. The antimony in the stomach may be precipitated by tannic acid in doses of 30 grains (2.0); the tannate thus formed should be washed out. If the acid is unobtainable a strong infusion of hot tea may be substituted. The gastric irritation may be alleviated by mucilaginous drinks and milk. The cardiac depression should be combated by means of hypodermatic injections of alcohol, æther or strychnine and hot applications to the abdomen and extremities are indicated.

Chronic antimony poisoning is of rare occurrence and difficult of diagnosis, the symptoms being of indefinite character. They consist of headache, vertigo, depression, impaired vision, nausea, vomiting, gastric disturbance with pain, diarrhœa, albuminuria, emaciation, weakness, exhaustion and ultimate collapse. The resemblance of the symptoms to those of catarrhal gastro-enteritis renders the diagnosis of chronic antimony intoxication, when the drug is given with homicidal intent, very difficult.

After death antimony is said to be found in the liver, spleen, kidneys, bones and muscles; fatty degeneration of the viscera is also observed. The protracted administration of tartar emetic is stated to produce pustular eruptions.

Treatment consists in stopping the drug and in the employment of symptomatic and stimulative measures.

IODISM.

Iodism, the term applied to the train of symptoms resulting from the prolonged administration of the iodides, is induced by all these salts; the basic ion does not appear to be concerned in the effect produced. Owing to the fact that iodine is more readily freed from it, ammonium iodide is said to be more likely to cause iodism than the other salts.

Symptoms. These may be separated into two groups. (1) Frequently there is catarrh of the respiratory passages which commences in the nasal mucous membrane and is evidenced by a profuse watery discharge; the inflammation extends upward and downward producing conjunctivitis and perhaps severe headache due to involvement of the frontal sinuses. Accompanying this there is faucial swelling and irritation, the tonsils may become inflamed, and laryngitis and bronchitis may result. Laryngeal œdema may occur and cause death unless relieved. Somewhat later an eruption may appear, consisting of erythematous patches or papules which may become pustular; other eruptions have been observed. Œdema of the face is met in some instances and there may be albuminuria. Nervous manifestations such as neuralgia, tinnitus aurium, convulsive movements, disturbed intellection and, rarely, atrophy of the mammæ and testes, have been described. (2) Iodic cachexia, in which rapid emaciation takes place, is a late phenomenon and intense cardiac palpitation and ravenous appetite may develop.

The local manifestations of iodism can sometimes be prevented by the administration of alkalies and hence it is thought that the variation of their extent in different individuals, or in the same person at different times, may be explained by a varying degree of acidity. A tolerance may be established and sometimes the symptoms disappear while the drug is still being taken. Even though the manifestations may be intense they usually cease soon after treatment is discontinued and the chewing of pellitory will hasten the elimination of iodine in the chronic forms. When iodic cachexia has occurred the symptoms may not disappear for a considerable time.

BROMISM.

This term has been given to the toxic symptoms resulting from the prolonged administration of the bromides. The condition is rarely caused by hydrobromic acid although this substance contains a relatively large proportion of bromine.

Symptoms. The first of these is usually a papular acneiform eruption appearing chiefly upon the face and back. In marked instances the papules become pustules which may coalesce, forming small abscesses which at times become ulcers. At other times the rash resembles eczema and sometimes there is an erythema or a brown pigmentation of the skin. The tongue is

coated and there are digestive disturbances; frequently there is a coryza which may be associated with increased bronchial secretion and mild conjunctivitis. These manifestations are attributed to a local irritant action partly due to the salt action of the bromine salt and partly to decomposition of the bromide, with liberation of bromic acid and bromine by the free acids in different situations, as hydrochloric acid in the stomach, carbon dioxide in the air passages, etc. This action takes place more readily in old age and if renal insufficiency is present. From the influence of the drug on the nervous system the cutaneous sensibility and the sensitiveness of the faucial mucous membrane are distinctly reduced while the sexual desire becomes diminished. There is indisposition on the part of the patient to any exertion, he is easily fatigued, his gait is uncertain and there is often marked muscular tremor. The intellect is dulled and the memory impaired, the patient takes little interest in his surroundings, his speech is slow and he may stammer, mispronouncing words or omitting several from a spoken sentence. The facies is apathetic and stupid and the eyes are heavy and without lustre. Mental excitement, confusion and sometimes delirium may follow the continued use of moderate doses, especially of the potassium salt. The habitual user of bromides is unable to sleep without them, and a gradual increase of the dose is required to induce slumber, consequently the systemic effects are usually disastrous. In addition the patient's powers of resistance to disease are lowered and intercurrent affections, such as pneumonia or even bronchitis, may result in death. Notwithstanding the severity of the symptoms of bromism, they soon disappear after the withdrawal of the drug and its elimination from the system.

Treatment consists in stopping the administration of the bromides and in the employment of measures calculated to relieve the symptoms and to support the patient.

BORISM.

The continued internal use of too large amounts of boric acid or borax (sodium biborate) results in a train of symptoms which has been denominated borism. In some instances even moderate doses of these substances have a mild aperient action while in large amounts they are gastro-intestinal irritants and cause emesis and purging. Other symptoms produced by toxic quantities are dryness of the pharynx and dysphagia, intense muscular weakness, pain in the back and vesical tenesmus with albuminuria and sometimes hæmaturia, impairment of sight, headache, insomnia and nervous depression, which may be followed by fatal collapse. A rise of temperature is frequently observed and in 2 or 3 days, if death does not supervene, scaly, papular or eczematous eruptions appear upon the skin. The symptoms are evidenced more rapidly when the drugs are taken by mouth but manifestations of the same character may result from their free application in the

rectum, vagina or other parts. Boric acid and borax are rapidly absorbed from the mucous membranes and from abrasions, and serious instances of poisoning have been reported as due to the use of the acid as an antiseptic dressing.

In chronic poisoning the symptoms are often very similar to those of acute intoxication, the cutaneous manifestations are, however, more prominent and may constitute the only positive evidence of toxic effect, although there are usually indications of more or less gastro-intestinal and renal irritation. Œdema of the face and extremities may occur as a result of the latter, and consequently it is advisable to keep a careful watch of the condition of the urine whenever these drugs are administered. The hair often becomes dry and falls, and the eruption upon the skin may resemble a seborrhœic eczema, appearing as reddish patches which desquamate like psoriasis, or papules attended with marked pruritus. The most common eruption is said to be scaly, assuming the form of a seborrhœic dermatitis, but usually associated with much more œdema. Sometimes the skin and mucous membranes are dry, the lips become fissured, the nails are striated and a blue line similar to that of plumbism may appear upon the gums. The question of the effect of the continued and habitual introduction into the organism of boric acid or borax as employed in the preservation of food, is of considerable interest. The results of careful experimentation conducted by the Bureau of Chemistry, United States Department of Agriculture, show, on the whole, that $7\frac{1}{2}$ grains (0.5) daily is too much for a normal man to receive regularly; on the other hand a normal individual may take this quantity of boric acid or borax, expressed in terms of boric acid, for a limited period of time with slight danger of injuring the health. The chief objection to the employment of these substances as food preservatives seems to rest upon the fraud in permitting inferior goods to be marketed as high class products. This applies especially to meats and milk although the addition of small quantities of these substances may be beneficial since it delays the souring of the latter. If larger amounts are used with fraudulent intent, the milk is apt to be kept too long, to be of poor quality and the quantity of the preservative may be sufficient to injure infants who take the milk as a routine.

Treatment consists in stopping the ingestion of the adulterated food stuffs and the employment of means calculated to relieve the existing symptoms.

ALCOHOLISM.

Acute Alcoholism.

Definition. The result of the imbibition of a considerable amount of alcohol in any of its forms and within a short space of time. The quantity necessary to produce drunkenness varies greatly with the individual.

Symptoms. These are chiefly referable to the nervous system and, while the sequence of their appearance is not constant, there is usually a primary stage of excitation during which the subject's face becomes flushed, his eyes brightened and his tongue garrulous; the speech is at first coherent but soon becomes senseless; muscular coördination is disturbed as evidenced by the staggering gait. Locomotion soon becomes impossible and finally alcoholic coma supervenes. Other individuals are differently affected; instead of the primary excitement being evidenced by jollity and good nature it may be characterized by moroseness and the subject may be incited to violence and even murder by very slight provocation. The stage of narcosis, however, ultimately ensues as in the previously described type of alcoholism, if sufficient liquor is taken.

Alcoholic coma is not always easy of diagnosis. The face is usually flushed but may present a cyanotic appearance, the pulse is strong and full, respiration is deep, slow and sometimes stertorous. The temperature may be subnormal, at times even below 90° F. (32.2° C.). The urine and fæces may be passed involuntarily, the pupils are dilated and muscular twitchings may be present. The individual may be temporarily aroused in most instances by pressing upon the upper margin of the orbits at the junction of their inner and middle thirds—the points of emergence of the supra-orbital nerves. There is usually an odor of alcohol upon the breath. One of the most common of the mistakes to which the young ambulance surgeon is liable is the confounding of basilar fractures of the skull for alcoholism. This mistake is rendered a particularly easy one by the frequence with which the two conditions co-exist. In fracture the coma is usually deeper, the respiration stertorous and the pupils are often unequal. Bleeding from mouth, nose or ears is very characteristic. The difficulty of differentiation is often so great that it is always the part of wisdom to give the patient the benefit of every doubt and to consider all dubious instances of coma as proper for admission to a hospital.

Cerebral apoplexy may be separated from alcoholic coma by its deeper unconsciousness, pupillary inequality, the evidences of cardiac or vascular disease or of partial paralysis.

In *uræmic coma* the taint of alcohol upon the breath is lacking, the pulse is likely to be of high tension and the patient may exhale a urinous odor. The pupils are variable; the urine when drawn by catheter shows the presence of albumin and casts.

A consideration of acute alcoholism is not complete without mention of the very serious effects of indulgence in diluted *methyl alcohol* (*wood alcohol*). This liquid is often drunk by confirmed alcoholics when it is impossible to procure ordinary liquors. The effects of this form of alcohol are more prolonged than those of ethyl alcohol, lasting from 2 to 4 days, while those of the

latter seldom persist for more than one-quarter of this time. The most permanent effect is upon the optic nerves, blindness, which may last for a long time, and optic neuritis are common sequences of the ingestion of this substance. (See also p. 316.)

Treatment. Recovery from the acute effects of alcohol is usual even if no treatment is administered; the event may, however, be hastened by thoroughly washing out the stomach, or, if the patient is able to swallow, by giving an emetic consisting of 20 grains (1.33) each of powdered ipecac and zinc sulphate, or of warm mustard water—2 drachms (8.0) to 8 ounces (250.0). The hypodermatic administration of $\frac{1}{15}$ to $\frac{1}{10}$ of a grain (0.0044 to 0.006) of apomorphine hydrochloride is an efficient method of relieving the stomach of its contents and at the same time bringing about a diminution of violent nervous symptoms if these are present. These latter may be usually controlled by the administration of hydrated chloral in dose of 10 to 20 grains (0.66 to 1.33) with 1 or 2 drachms (4.0 to 8.0) of sodium bromide. If stimulation is necessary the patient may receive a drachm (4.0) of aromatic spirit of ammonia and if there is any tendency to collapse, frictions and hot applications should be employed. When convulsions are present, which is rarely the case, a little chloroform should be given by inhalation until the sedatives given by mouth have had time to exert their effect.

Chronic Alcoholism.

Definition. A condition resulting from the habitual and intemperate use of alcoholic beverages. What constitutes the "intemperate use" of alcohol cannot be definitely stated, for certain individuals are able to take without apparent harm quantities of this substance which would exert, in more susceptible subjects, most marked untoward effects.

Dipsomania is a form of chronic alcoholism, the tendency to which is hereditary, which is characterized by a periodic desire for alcoholic excess and is evidenced by debauches at varying intervals, the subject being wholly free from the craving during the intervening periods.

Effects of Chronic Alcoholic Poisoning. Among the common results of chronic alcoholism are chronic gastritis, gastric dilatation, especially in beer drinkers, hepatic cirrhosis, delirium tremens and mania. Many other diseases have been attributed to the effects of the chronic use of alcohol among which may be cited gout, peripheral neuritis, pachymeningitis, organic heart disease and chronic nephritis; in fact, but few organs and tissues are not changed in some way in chronic alcoholism and its results. Of the changes met in this condition two groups are described, namely *sclerosis* and *steatosis*. While these anatomical alterations are in process of development the exterior of the body assumes characteristic appearances. The individual may be

either pale and flabby, but fat, with a heavy and imbecile expression or he may have a dusky red or purplish, pimply and bloated skin, with swelling under the eyes, yellow and injected conjunctivæ, and blue and thickened lips.

Alcoholics are especially likely to contract pneumonia, tuberculosis and other infectious diseases, and, when attacked by them, show less resisting power than do previously healthy persons. They are also bad subjects for surgical operations and bear anæsthesia poorly.

The *post mortem* changes in the organs and tissues of alcoholic individuals show no characteristic changes, there is often found, however, in patients dead from *mania a potu* an œdematous condition of the brain and its membranes, the so-called *wet brain.*

Symptoms. These are referable to the various organs and systems whose functions have been impaired and whose structure has been altered by the effect of the alcohol.

The Digestive System. Chronic catarrhal gastritis is an almost constant affection in the chronic alcoholic. It is evidenced by anorexia, foul tongue and breath, constipation, nausea and vomiting, especially before eating in the morning, the so called "*water brash.*" Often these symptoms are relieved by the day's first potation.

The liver is subject to definite changes partly as a result of chronic overindulgence in alcohol and from accessory products used in manufacture or from additional substances introduced in "blending." From these arise symptoms in accordance with the existing conditions of cirrhosis, fatty degeneration, etc. These changes by no means always occur but are frequent and as a result of the compression of the portal circulation, due to the cirrhosis and consequent contraction of the new interstitial tissue, various manifestations appear, such as those due to congestion of the gastric mucous membrane, hæmorrhages from the alimentary tract, hæmorrhoids, splenic enlargement, etc. The characteristic facies of the alcoholic with its dilated veins, reddened nose—which is often the *acne rosacea* of the dermatologists—the swellings beneath the eyes and the icteric conjunctivæ, usually accompanies the disorders of the digestive tract and liver.

From the changes in the *circulatory system* the symptoms due to cardiac, renal and arterial disease result. Of these vertigo, apoplectic seizures and the various other manifestations of arterial degeneration are most important.

The Nervous System. Such symptoms as tremors of the hands and tongue and unsteadiness in the control of muscular acts are very common; the mentality is sluggish, the patient is irritable, restless and deteriorates morally; the memory is impaired and the intellect becomes weakened generally; finally dementia and insanity may supervene. Multiple peripheral neuritis is frequent and will be considered elsewhere. Epilepsy may also occur as a sequence

of chronic alcoholism but is likely to disappear with the resumption of proper habits. At times there develops with an alcoholic neuritis, and sometimes by itself, a peculiar condition characterized by hallucinations of sight, labial tremors, thickness of speech, impairment of memory, disordered ideas of time and space and imaginative explanations of actual incidents, to which the term *psychosis polyneuritica* or *Korsakoff's disease* has been applied.

Changes in the nervous system are found after death but are not characteristic; of these hæmorrhagic pachymeningitis, thickenings and opacities of the pial and arachnoid membranes, and even, in advanced instances, encephalomeningitis with meningeal adhesions should be mentioned.

Treatment. Chronic alcoholism can hardly be treated satisfactorily at the patient's home; success is far more readily attained at an institution where outside influences can be excluded, alcohol cannot be obtained unless considered advisable by the physician in charge and the patient can be kept under the strict supervision of attendants. An excellent substitute for institutional treatment is a prolonged sea voyage or a sojourn in the woods such as is afforded by a hunting or fishing trip where no alcohol is taken and the inebriate is associated with one or more congenial companions who are not drinkers. It is the present uniformly held belief that an entire withdrawal of the alcohol is better than a gradual "tapering off" unless the abstention results in an attack of delirium tremens, when it is usually necessary to allow the drug in varying amount. The substitution of narcotics, such as chloral, cocaine and the like, for alcohol is to be unhesitatingly condemned. Sleeplessness and nervousness may be controlled by the administration of the milder hypnotics such as the bromides, sulphonmethane (sulphonal), sulphonethylmethane (trional), veronal and paraldehyde. Morphine should not be used unless the patient's condition renders it absolutely necessary and other sedatives have failed. Even then it should not be prescribed as a routine but occasionally only, for the danger of acquiring the habit is great.

Hyoscine hydrobromide has recently been advocated as an excellent means of allaying the desire for alcohol and the nervous symptoms which follow its suspension. It may, if necessary, be given to the physiological limit even to the production of dryness of the mouth and delirium. Doses of $\frac{1}{100}$ of a grain (0.0006) may be administered hypodermatically every 2 or 3 hours until the nervous manifestations are relieved. These may be kept in a state of abatement by less frequent doses until the drug finally is entirely stopped.

The much exploited gold cure and other advertised institutional treatments possess no special recommendation.

The addition of apomorphine or other substances to the liquor taken by the patient and the hypodermatic administration of the former drug after drinking may produce a distaste for alcohol. It has also been asserted that hypodermatic doses of $\frac{1}{100}$ of a grain (0.0006) of atropine sulphate given

several times a day will shortly render alcohol distasteful to the patient and productive of emesis without the addition of nauseating drugs.

During treatment the patient's digestion should be kept in as good condition as possible, the bowels should be regulated by means of mild laxatives or by occasional purgation with fractional doses of calomel followed by a saline, and stomachic bitters together with such tonics as strychnine and cinchona are useful. Any tendency to circulatory failure must be combated by the ordinary means, strychnine, digitalis, etc. Acute syncope or collapse necessitates the hypodermatic administration of diffusible cardiac stimulants, such as camphor and æther, and of the aromatic spirit of ammonia or the compound spirit of æther by mouth.

The diet should be nourishing, abundant and easily digestible. Tea and coffee, on account of their stimulant properties may be allowed.

Delirium Tremens.

Synonym. Mania a Potu.

Definition. An effect of the prolonged use of alcohol characterized by delirium with hallucinations and extreme prostration.

Symptoms. The syndrome delirium tremens is a result of the prolonged action of alcohol upon the cerebral cells but is often induced by a sudden withdrawal of the drug. Alcoholic excess in a temperate individual does not bring on an attack but a debauch may be followed, in the case of a chronic alcoholic, by typical *mania a potu*. Alcoholic subjects are very prone to attacks when prostrated by acute disease, particularly pneumonia. Delirium tremens is also a frequent consequence in alcoholics of a mental shock or physical injury such as a fractured limb or other result of traumatism. Prevention may be possible, in the latter instances, by allowing these patients alcohol in moderate quantity.

The onset of an attack is marked by sleeplessness, restlessness and depression; these symptoms are shortly succeeded by a delirium characterized by hallucinations of sight and hearing. Talking is continuous and incoherent and restraint may be necessary, for the patient may desire to leave the house on imaginary business. The delusions of sight may take the form of animals rats, mice, snakes, insects, etc., which the patient imagines are pursuing him or crawling about his bed or over his body. The fear induced is intense and constant watching is necessary to prevent attempts to escape. The hallucinations of hearing are less usual but conversations with imaginary persons may be carried on, imaginary voices and noises may be heard. Muscular tremor is marked and sleep is impossible. There is extreme weakness and the pulse is soft, frequent, compressible and, perhaps, irregular. The tem-

perature is elevated to 101° to 103° F. (38.3° to 39.5° C.) unless acute complications are present, when it is higher.

The diagnosis is simple. The patient should be thoroughly examined when first seen for surgical injuries and daily physical examination of the lungs is necessary, for congestion at the bases is frequent and may develop into pneumonia; on the other hand pneumonia, especially that at the pulmonary apices may be accompanied by a delirium resembling that of *mania a potu*. Meningitis, a serous form of which (*wet brain*) is often present, simulates in its symptoms delirium tremens, but may be differentiated from the latter condition by an absence of alcoholic history and the patient's appearance.

The prognosis varies, but, if there are no complications present, recovery usually takes place within a week, the hallucinations, sleeplessness and tremors gradually disappearing. In hospitals, however, the type of alcoholic subject generally observed is in a weakened and debilitated state and the death rate is consequently high, the patient gradually falling into the typhoid condition with feeble and dicrotic pulse, dry and cracked tongue, and low, muttering delirium; death from cardiac failure supervenes in a great number of instances. In patients who recover recurrences are common.

Treatment. The patient should be put to bed in a quiet darkened room; alcohol should be withdrawn unless its administration is necessary to combat adynamia; even if there is marked cardiac weakness in many instances it is preferable to stimulate by means of ammonium which is best administered as the solution of the acetate (liquor ammonii acetatis) in doses of ½ an ounce (15.0) repeated every 2 or 3 hours if necessary. The aromatic spirit is also useful and may be given in doses of ½ to 1 drachm (2.0 to 4.0). Strychnine sulphate, $\frac{1}{30}$ of a grain (0.002) or more, if indications are present, may be employed as well.

The relief of the sleeplessness is most important and may be accomplished by the administration of the bromides and chloral, ½ drachm (2.0) of sodium bromide with 10 to 15 grains (0.66 to 1.0) of hydrated chloral often being sufficient. Chloral, however, should not be employed if there is tendency to heart weakness. The writer has obtained excellent results in his service in the alcoholic wards of Bellevue Hospital with paraldehyde in doses of 2 drachms (8.0) frequently repeated if necessary. Sulphonethylmethane (trional), in doses of 10 to 20 grains (0.66 to 1.33), is also useful and often acts well when given in combination with 5 grains (0.33) of veronal. If the delirium is uncontrollable by other means hyoscine hydrobromide—$\frac{1}{100}$ of a grain (0.0006)—may be given hypodermatically. Morphine should be administered with caution if at all; when all other measures fail it may be given hypodermatically in doses of ¼ of a grain (0.016) but should seldom be repeated more than twice, the effects being watched with great care. Cold

baths and hot or cold packs, repeated if necessary, are often useful in the relief of the restlessness.

If there are symptoms indicating meningeal involvement (wet brain), such as stiffness and rigidity of the neck, etc., the ice helmet should be applied.

Restraint is often necessary to keep the patient in bed and here the employment of a folded sheet placed across the body and pinned under the mattress is to be preferred to straps.

At the beginning of the treatment the bowels should be freely moved and throughout the course of the affection the channels of elimination should be kept open by means of frequent draughts of water and laxatives when necessary.

The patient's strength should be maintained by means of frequent feeding with easily digestible and assimilable foods, such as milk, peptonized if preferred, and nourishing soups. As the symptoms ameliorate a gradual return to ordinary diet should be allowed.

METHYL ALCOHOL POISONING.

Of late years numerous instances of poisoning by methyl (wood) alcohol or Columbian spirits have been reported; this is probably due in great measure to the fact that methyl alcohol is being used as a substitute for ethyl (grain) alcohol in the manufacture of many preparations. Even such substances as flavoring essences, etc., have been made with the cheaper alcohol, while it is common enough to find varnishes, bay rum, cologne, so-called witch hazel extracts and the like mixed with wood alcohol; it is probable, however, that the recently enacted pure food and drug laws will, to a great extent, do away with this pernicious form of adulteration.

Even the inhalation of the fumes of methyl alcohol, as may occur after the interiors of beer vats or small rooms have been varnished, may cause toxic symptoms, and it is quite probable that in susceptible individuals even a single "alcohol rub" may produce untoward manifestations through the absorption of the alcohol through the skin. The larger number of instances, however, of methyl alcohol intoxication are the result of drinking the fluid, either diluted with water or unknowingly in the form of adulterated liquors, ginger essence, cologne, etc. Idiosyncrasy apparently plays an important part in the type and severity of the toxic symptoms for, as stated by Buller and Wood, some individuals are largely immune so far as permanent damage to the organism is concerned. Of ten persons who take 10 ounces (300.0) of Columbian spirit within three hours all will exhibit marked abdominal distress and four will die, two of these becoming blind before death takes place. Six will finally recover and of these two will remain permanently blind. If larger

amounts than the above are taken the proportion of mortality and blindness will be greater.

Methyl alcohol intoxication occurs in an acute and a chronic type. In *the acute type* the symptoms are, in general, analogous to those observed in individuals poisoned by grain alcohol (see the section upon acute alcoholism) but the manifestations are produced more slowly than is the case with the latter substance and the duration of the intoxication is more persistent.

The first noticeable symptom of acute methyl alcohol poisoning may be a state of exhilaration and excitement resembling that of ordinary drunkenness; in almost all instances the patients have complained of marked headache, nausea, active and persistent emesis and profuse perspiration. Pupillary dilatation is the rule, delirium is frequent and is usually followed by coma which may continue for several days and sometimes ends in death.

The most interesting and characteristic symptom of methyl alcohol intoxication is blindness; this has been observed in a large proportion of individuals who have suffered from the effects of excessive amounts of this substance and may be transient or permanent. Impairment of vision is very commonly seen and while in such instances the normal sight may be recovered, in those instances in which the blindness has been total it is a rare occurrence for the eyes to regain their normal power. The ocular disturbance may be the only symptom of the intoxication which is evidenced by the patient, here the blindness may not appear for several days after the ingestion of the alcohol. Following the incidence of the blindness the sight may temporarily return only to be lost again after a few days or weeks.

The amaurosis is the result of optic nerve atrophy; at times the color sense is chiefly affected and in other instances, while peripheral vision is preserved, the visual fields are contracted. Absolute central scotoma is very constant.

The fatal dose of methyl alcohol is variable; death has followed the ingestion of one-half pint ($\frac{1}{4}$ litre) and in other instances considerably less than this quantity has brought about a fatal outcome.

The prognosis is distinctly bad. Death has followed large doses in a few hours, but in general it does not occur for a day or two.

Prevention. This may be to some extent accomplished by prohibiting the sale of deodorized methyl alcohol in all its forms. All preparations, containing the substance should be labeled poison and individuals using it as an adulterant for food or drink should be prosecuted. When used in the arts is may be made undrinkable by the addition of a small percentage of naphthalin.

Treatment. The first indication is immediate emptying of the stomach by means of gastric lavage and the intestines by means of purgation and high rectal irrigations. The cardiac and respiratory weakness should be combated by such stimulants as ethyl alcohol, strychnine, digitalis and caffeine.

The collapse necessitates the employment of hot applications to the body and extremities in connection with rectal injections of hot coffee. It has been shown that the administration to animals of sodium bisulphite with methyl alcohol increases the formic acid output in the urine; as methyl alcohol is excreted, in part, at least, in the form of this latter substance, sodium bisulphite might prove useful as a therapeutic agent.

Little is to be expected of treatment directed at the amaurosis. The use of pilocarpine, potassium iodide in the early stages, and the later administration of strychnine, is advised.

The chronic type of methyl alcohol intoxication may follow the frequent taking of small quantities of liquids (essence of ginger, peppermint, cologne, etc.) and is an insidious and doubtless not a rare form of poisoning. It is difficult of recognition in the absence of suggestive history, but it is quite certain that it results in disorders referable to the eyes and the digestive and nervous systems.

CHLORALISM.

The chloral habit is very easily acquired by individuals who have employed hydrated chloral in ordinary doses for even a short time for the relief of sleeplessness or any other purpose, and, once established, produces serious results and is difficult of cure.

Symptoms. The patient suffers from digestive disturbances and diarrhœa, extreme mental and physical weakness with sudden flushings due to vaso-motor derangements, cardiac palpitation, and from erythematous eruptions, usually purplish in color, and especially affecting the face; sometimes they are found upon the mucous membranes. In some instances bed sores and ulcerations appear. Dyspnœa, due to depression of the heart action and the respiration and the general bodily weakness, is a marked symptom; the temperature is often subnormal. The patient sleeps only when under the influence of the accustomed hypnotic and death in collapse may at any time follow an over-dose, since by reason of the cumulative effects of the poison in the system the vital functions are greatly impaired and elimination is rendered impossible. Sudden withdrawal of the drug may cause symptoms analogous to those of delirium tremens; such a condition is dangerous, as fatty degeneration of the heart is likely to be present.

Treatment should be carried out upon the same lines as those to be described in dealing with the morphine habit. Isolation and careful attendance are necessary; stimulation of the heart by means of ammonia, strychnine and digitalis is indicated; the sleeplessness may be controlled by the bromides, sulphonmethane (sulphonal), sulphonethylmethane (trional) or veronal

a combination of the two last consisting of 10 or 15 grains (0.66 to 1.0) of trional to 5 grains (0.33) of veronal is often quite effectual. Morphine may be employed only as a last resort. Tonics, plenty of nourishing food and congenial occupations, together with electricity and massage, are useful adjuncts to treatment.

SULPHONMETHANE (SULPHONAL) POISONING.

Fatal instances of poisoning by sulphonal have been reported as occurring from small doses of this drug continued for long periods. The excretion of this substance seems to be slower than its absorption and consequently there is a tendency to a cumulative action. This may lead to gastritis, renal disease and certain not very clearly understood changes in the blood. As a result of the last there is a characteristic discoloration of the urine due to the presence in it of a reddish-brown pigment, hæmatoporphyrin, which is an iron-free product of the decomposition of hæmoglobin. This occurs chiefly in women and is associated with constipation, vomiting and gastric pain, weakness and ataxia, confusion and partial paralysis; eventually suppression of the urine, collapse and death may result. Though the continued use of the drug may not induce these grave manifestations it may be attended by severe functional disturbances such as mental, moral and physical deterioration, indigestion, impaired nutrition and cutaneous eruptions.

Enormous single doses have been known to cause paralysis of the sphincters, anuria, subnormal temperature and, as a late symptom, respiratory depression.

Treatment. The untoward effects of sulphonal can usually be avoided by intermitting its administration from time to time and by the daily use of the alkaline mineral waters either still or carbonated. When toxic symptoms have appeared the drug should be stopped at once. The treatment otherwise is symptomatic and supportive.

SULPHONETHYLMETHANE (TRIONAL) POISONING.

The symptoms resulting from the continued use of trional are analogous to those of sulphonal poisoning. They consist of hebetude, drowsiness, anorexia, and muscular weakness; the frequency of the pulse is diminished and, in marked instances, vertigo, ataxia and, more rarely, hallucinations and delirium may be observed. Hæmatoporphyrinuria occurs and upon its appearance the administration of the drug should be stopped.

Treatment consists, as in sulphonal intoxication, of the employment of means to favor elimination and to support the patient. The symptoms should be combated by the indicated measures as they arise.

VERONAL POISONING.

A few instances of poisoning due to this drug have been reported. In one patient its administration resulted in a febrile movement which lasted about a week, dryness of the mouth, a morbilliform rash upon the face, chest and arms, which later became confluent and was followed by a vesicular and bullous eruption upon the mucous membrane of the mouth and pharynx, conjunctivitis and aural pain. A dose of 24 grains (1.66) has produced the symptoms of narcotic poisoning followed by a universal cutaneous erythema which recurred after a second dose and in addition the patient suffered from periodic delirium.

The prolonged employment of veronal may result in the appearance of cerebral dulness, drowsiness, a staggering gait, nausea and vomiting and hæmatoporphyrinuria.

Treatment consists in stopping the drug, alternation with hypnotics of other types, the administration of alkaline mineral water and securing a daily movement of the bowels.

MORPHINISM.

Synonyms. Morphinomania; The Morphine Habit.

The morphine habit is often acquired by patients for whom the drug has been prescribed by a physician to control obstinate pain or sleeplessness, or more frequently from self-administration or the use of certain patent medicines. It is particularly frequent among women who are affected with painful conditions and among physicians themselves. Individuals of neurotic tendency are more subject to the contraction of the habit than those whose nervous systems are stable, and heredity is a recognized predisposing ætiological factor. Alcoholics often become morphine *habitués*, the drug being first taken as an aid in the attempt to overcome the craving for liquor. The morphine is taken either by mouth or hypodermatically, and, while certain subjects continue to take the same small quantity of the drug, the tendency is to gradually increase the amount until 30 grains (2.0) a day or even more are employed. In the East opium eating and smoking are as common as the use of tobacco is with us but the oriental constitution seems much better able to withstand the effects of the drug than does that of the Caucasian.

Symptoms. The continued use of small doses of morphine may for a long time result in no marked manifestations other than a craving for the drug, but sooner or later the functions of both body and mind become affected. While under the influence of the morphine the patient may feel well, but as the effects disappear mental disquietude, depression, nausea and perhaps

colicky abdominal pain follow, which can be relieved only by further recourse to the drug. The character of the morphinomaniac becomes deteriorated and is typified by lack of self-control and of moral sense—the subjects of the habit being notoriously untruthful—there is an irritability of temperament, sleeplessness is frequent, the appetite is poor and nutrition becomes impaired; the pulse is weak and rapid, sweating and itching of the skin are common and constipation is the rule. The appearance of the patient is somewhat typical, the skin being sallow, the pupils dilated and the facies prematurely aged; œdema of the limbs may be present. When under the influence of the drug the pupils are contracted and the mental and physical condition usually seems much more normal. Morphine *habitués* finally become subject to muscular tremors, and, women particularly, are likely to exhibit hysteric and neurasthenic symptoms. The deteriorated constitution becomes an easy prey to disease and usually the end comes as a result of intercurrent affection or of weakness induced by the lack of the maintenance of nutrition.

Certain subjects live to moderate old age and even, though the habit is continued, are able to transact the usual duties of life; these, however, are generally the rare individuals who get along upon a small and not increased quantity of the drug.

The prognosis is variable, depending upon the strength of character of the patient and upon his surroundings. Relapse is very common.

Treatment. Much may be done by the physician in the way of prevention of the morphine habit. The indiscriminate prescribing of the drug cannot be too strongly condemned and it is a positive crime to put a hypodermatic syringe into the hands of a patient to be used in the control of pain or sleeplessness. When morphine is indicated it is an invaluable drug, but it is best not to tell the patient that he is receiving it, and all prescriptions should be marked "not to be refilled without order of the physician."

In the treatment of morphinism institutional seclusion is an absolute essential, for the closest watchfulness upon the part of attendants cannot prevent the patient from procuring the drug if he is in his own home; even in institutions it is often difficult to prevent his access to morphine for friends may be persuaded and servants bribed to obtain it for him. The treatment is one offering immense difficulties at best, on account of the degraded moral condition of the *habitué* and is very frequently unsuccessful in effecting a cure. Isolation is necessary and the patient should be watched with the utmost vigilance to prevent him from securing the drug surreptitiously. The morphine must not be withdrawn suddenly, since this is likely to be attended by collapse and aggravated mental disturbance, but the quantity should be gradually diminished until it is considered wise to stop it altogether, which can usually be done at the end of about a week. The withdrawal of the morphine is followed in many instances by diarrhœa, insomnia, irritability and extreme

mental and bodily depression. Medication is often necessary to combat these symptoms. Stimulation of the heart for weakness, if this is present, by means of ammonium, strychnine, digitalis or caffeine may be indicated; alcohol should not be employed on account of the possibility of inducing its habitual use; cocaine is contraindicated for the same reason. The gastric symptoms should be relieved by appropriate methods, and the same is true of constipation and diarrhœa. The intestinal atony which is the cause of the former is best combated by the administration of physostigmine salicylate in doses of $\frac{1}{100}$ of a grain (0.0006) twice a day; the diarrhœa may be controlled by bismuth subsalicylate in 20 grain (1.33) doses every 4 hours or by other salts of this metal with vegetable astringents. The appetite may be stimulated by means of the vegetable bitters and by palatable and highly seasoned food, plenty of nourishment being an important consideration; plenty of milk and rich broths should be given. The insomnia and nervous irritability may be relieved by the bromides, sulphonmethane (sulphonal) in doses of 20 grains (1.33) in warm milk, sulphonethylmethane (trional) or veronal in doses of 10 to 15 grains (0.66 to 1.0), and by chloral formamide (chloralamide) in doses of 15 grains (1.0). Hydrated chloral may be employed in emergency but the possibility of habit formation must not be forgotten; this drug is contraindicated in the presence of cardiac weakness. Hyoscine hydrobromide and morphine itself are sometimes necessary. The mental excitement may often be controlled by warm or cool baths or packs.

Within the past few years treatment by means of the systematic administration of hyoscine hydrobromide has been advocated. The patient is placed under the careful supervision of attendants, the morphine is stopped and hyoscine is given hypodermatically in large quantity, even as much as $\frac{1}{100}$ of a grain (0.0006) every 2 or 3 hours, until the restlessness and nervous irritability are under control. Sleep may not ensue but a condition of semi-stupor may be produced during which the patient often talks incoherently. The physiological effect of the drug as evidenced by dryness of the mouth may not be noticeable. The patient is kept under the influence of the hyoscine for several days until the more acute craving for morphine has disappeared, the effects of the drug are then allowed to wear off and in fortunate instances the patient may have been weaned from his habit. If there are signs of cardiac failure stimulation by means of strychnine is indicated. Rather remarkable cures have been reported as resulting from this treatment, but relapse is as common as after other forms.

In conclusion it may be asserted that no known drug appears to possess any specific effect in controlling morphinomania; no reliance can be placed upon any of the advertised cures; most of these contain morphine and are consequently ineffectual, the others are made up of inert drugs and are frauds.

HASCHISCH (CANNABIS INDICA) POISONING.

Haschisch is largely employed in the Orient as a stimulant of the psychic functions and its moderate use does not seem to be attended by injurious effects. When taken to excess it leads to tremor, loss of appetite, muscular weakness and sometimes to mania and dementia. In some severe instances convulsive attacks have been observed and among the natives of India catalepsy is said to occur at times. The drug, if employed by Caucasians, would probably cause more serious results than are usual among Orientals.

Death from acute poisoning is rare, and recovery has taken place after very large doses. Shortly after the administration of the drug the patient experiences most pleasurable emotions, everything seems to amuse him, he becomes hilarious and indulges in actions which he realizes to be ridiculous; double consciousness is well marked. The patient is on the best of terms with those about him and passes into a dreamy, semi-conscious state in which he experiences ideas upon the most magnificent scale; time and space appear to be indefinitely extended. He may say brilliant or witty things but there is little relevance in his thought which changes rapidly from one subject to another. He experiences delightful visions; true hallucinations may be present. The general sensibility is much diminished and even complete anæsthesia may be noted. The pupil is usually somewhat dilated; later the dreams alternate with conscious periods and ultimately the patient falls into a quiet slumber from which he awakes without any sensation of depression, but refreshed and hungry.

The effects of cannabis indica vary greatly in different individuals as a result of personal peculiarities or of variations in the strength of the drug. Dryness of the mouth, thirst and strangury are occasional untoward symptoms.

Treatment. The treatment of acute poisoning by cannabis indica consists in emptying the stomach by lavage or emetics and the bowels by a purge; otherwise the management of the condition is symptomatic. In chronic haschisch intoxication the use of the drug should be stopped. Otherwise the treatment of the condition is symptomatic, eliminative and supportive.

COCAINISM.

The habitual use of cocaine is not at all infrequent. To it physicians are particularly prone, acquiring a desire for the effects of the drug as a result of its employment as a nasal or pharyngeal application. The habit may also be induced by the substitution of cocaine for morphine in the treatment of morphinomania. Cocainism is said to be quite common among the negroes in certain parts of the South. Neurotic individuals are more susceptible to this and other drug habits than persons of normal mental balance.

Symptoms. The victim of cocainism rapidly becomes emaciated and is subject to attacks of syncope. Circulatory disturbances, a feeble, thready pulse, insomnia, ocular disorders, such as amblyopia, mydriasis, and nystagmus, mental failure and delusions not unlike those of chronic alcoholism may be observed. Visual and other hallucinations, usually of disagreeable character are often present and one symptom which is regarded as typical of subacute or chronic intoxication with this drug is a sensation of crawling worms or insects ("cocaine bugs") under the skin. Sometimes there is delirium or acute mania. There seems to be a degeneration of the central nervous system similar to that which occurs in chronic morphinism. The moral deterioration which results is fully as marked as that observed in morphinomania. Cocaine is usually taken by hypodermatic injection; more rarely the powder itself is used as a snuff.

Treatment. Cure is often difficult, particularly if the habit is associated with morphinism or alcoholism. Relapses are frequent. The most important point in treatment is the withdrawal of the drug; it must be remembered, however, that sudden stopping of it may cause profound collapse. The result is seldom successful unless the patient is confined in an institution for considerable time and placed under the care of competent and faithful attendants. Tonics and stimulants are indicated just as in the treatment of chronic morphine poisoning. Plenty of nourishing food is necessary and the nervous manifestations should be controlled as in morphinism.

TOBACCO POISONING.

The symptoms which result from the over-use of tobacco by smoking, chewing or snuff taking are chiefly referable to the digestive and nervous systems. The tongue is coated, the breath is foul and there is chronic catarrh of the pharynx and larynx; nausea, vomiting, flatulence and constipation are common. Insomnia, muscular weakness, tremors and even ataxic symptoms may be observed. Amblyopia and scotoma may develop and cardiac palpitation and irregularity (*the tobacco heart*), sometimes with anginal and asthmatic attacks, are frequent. In prolonged instances the skin becomes sallow and the body emaciated.

Treatment consists in the absolute interdiction of the tobacco; this may cause marked nervous irritability and the craving for the drug for a few days is often very difficult to withstand. The sleeplessness and nervousness should be controlled by the bromides, sulphonmethane (sulphonal) or sulphonethylmethane (trional) and the cardiac condition may be relieved as suggested in the sections upon the treatment of cardiac irregularity and palpitation. The fluid extract of cactus grandiflorus made from the green plant,

30 drops (2.00) thrice daily usually relieves the latter symptom. Tonics and nourishing food are useful adjuncts to the treatment.

The employment of apomorphine hydrochloride in doses of $\frac{1}{30}$ of a grain (0.002) every 2 hours, gradually increasing the amount until nausea is experienced, has been suggested.

CARBON DISULPHIDE POISONING.

This substance is employed in the arts and especially in the vulcanization of rubber. Individuals exposed to its fumes may become emaciated and affected with headache, vertigo, nervous excitement, incoördination of movement and depression of the special senses with impairment of sensation and motility. Insanity is said to result in some instances. Chronic intoxication may be evidenced by a neuritis with paralysis analogous to that occurring in plumbism.

Carbon disulphide, when directly inhaled, excites violent coughing, and causes general anæsthesia with intense muscular rigidity. The drug is a powerful heart depressant, and even in small doses by mouth produces severe nausea and vomiting, with a burning sensation in the epigastrium, and a weak and rapid heart action.

Treatment. Something may be done toward the prevention of carbon disulphide poisoning by effecting free ventilation of the rooms in which the substance is used. Inhalers have been suggested, but, unless they are so constructed as to separate the toxic fumes from the inspired air, can be of little value. The treatment of the affection is wholly symptomatic. Phosphorus may be employed to combat the nervous manifestations.

LACQUER POISONING.

Workers in lacquer, which is manufactured from the balsamic gum of *Rhus vernicifera*, are subject to a distressing poisoning, the manifestations of which are cutaneous. This form of intoxication is observed chiefly in China and Japan and occurs both as a result of contact with the lacquer in its raw state and from inhalation of the air of apartments in which newly lacquered articles are exposed. The symptoms appear within a few hours after association with the poisonous substance and are evidenced by intense pruritus of the skin of the face, arms and legs; cutaneous œdema follows and papules appear which later become vesicles containing a yellowish seropurulent fluid. Coalescence of the vesicles may take place. A rise of temperature is observed in severe instances. If the eruption upon the face is intense in character the mucous membranes of the lips and conjunctivæ may

be involved as well. The eruption is said not to appear upon the trunk, only the face, limbs and scrotum being subject to this manifestation.

Treatment consists in the application of lotions calculated to allay the irritation. Of these lime water and a solution of sodium thiosulphate, 1 part to 8 should be effective. Dressings of the national formulary solution of alum acetate may be applied if the pustulation is marked.

FOOD POISONING.

Various forms of food when decomposed, contaminated or improperly prepared may cause toxic symptoms. In great measure the symptoms produced are caused by the presence of substances generated in the decomposition of organic matter. These have been termed *ptomaines* and occur in different types, some poisonous, others harmless; certain ptomaines may be innocuous under some conditions and under different circumstances markedly toxic.

Meat Poisoning (*kreotoxismus*) follows the ingestion of decomposed flesh. The most frequent form is sausage poisoning (*botulismus* or *allantiasis*) and is probably due to the employment of improper methods of preparation. Ham poisoning sometimes occurs and other meats have been known to cause toxic symptoms. Among these may be mentioned beef, veal, mutton, fowl, etc. Cured meats are responsible at times, and, while the tin or zinc hydrochloride derived from the cans may be at fault occasionally, the meat itself is often at the bottom of the evil.

Symptoms. These appear after an interval of from a few hours to a day or two and are evidenced by the manifestations of severe gastro-intestinal irritation. There are nausea, vomiting, abdominal pain and diarrhœa. The temperature is often elevated, and dryness of the mouth, thirst, dysphagia, headache, dizziness, dimness of sight and pupillary dilatation may be present; even delirium is observed at times. In instances which terminate in death the patient passes into a condition of collapse with muscular twitchings, coldness of the extremities and cardiac and respiratory depression.

Poisoning by Fish (*ichthyotoxismus*) **and Shell Fish.** Certain fish are known not to be fit for food, while others, edible at ordinary times, are poisonous during the spawning season. Diseased or decomposed fish, which in its normal condition and fresh is good to eat, may produce toxic symptoms under the former circumstances.

Shell fish, particularly mussels, may also cause poisoning. In the latter instance the term *mytilotoxismus* has been applied to the condition. The poison is found chiefly in the liver of the bivalve and it is not known whether a certain species is always toxic or ordinary mussels become poisonous under special circumstances.

Symptoms. Fish poisoning is marked by similar manifestations to those of meat intoxication. The symptoms are often intense and a generalized scarlatiniform rash may appear.

Mussel poisoning is evidenced by marked gastro-enteric irritation and frequently by the development of an urticarial eruption which may become vesicular; marked œdema of the eyelids is not uncommon. In frequent instances nervous symptoms such as convulsions, paralysis, delirium and coma are observed; death is not rare and in another type of patient may be preceded by rapid respiration and heart action, numbness and coldness of the extremities, dilated pupils, and collapse.

Poisoning by Dairy Products. Milk intoxication (*galactotoxismus*) may follow the ingestion of decomposed milk, and poisoning from cheese and ice cream (*tyrotoxismus*) may result from the presence of a ptomaine (*tyrotoxicon*) which has been isolated by Vaughan.

Symptoms. These are those of marked gastro-intestinal irritation analogous to that of meat poisoning.

Treatment of Food Intoxication. The first indication is to remove the poisonous substance from the digestive tract. The vomiting induced by the presence of the offending food is usually sufficient to relieve the stomach of its contents but if not we should have recourse to gastric lavage. The intestine should be emptied by repeated fractional doses of calomel followed by a saline. The abdominal cramps may be relieved by the application of hot water bags or compresses and by the hypodermatic injection of morphine if necessary. The tendency to collapse should be combated by the hypodermatic administration of alcohol and strychnine and, when the gastric irritation has passed, by stimulants by mouth. Feeding should be begun with care, milk diluted with one of the carbonated waters being first allowed. The treatment in other regards is symptomatic.

GRAIN POISONING.

The employment of various kinds of diseased or decayed grain as food is a common source of intoxication in certain countries.

Ergotism occurs among the lower classes in Europe where, after poor harvests the indigent are obliged to use bread made with rye contaminated with the *sclerotium*, an intermediate stage of development of the *claviceps purpura*, a fungus which attacks the rye grain. The disease is less common now than formerly.

Symptoms. Two types of ergotism are recognized. (1) The *gangrenous form*, which is characterized by an onset similar to that of the convulsive type, which is to be described in a later paragraph. In from a few days to

a month a redness, akin to that of erysipelas, appears in the fingers, toes or upon the nose or ears. Subsequently a dry gangrene usually develops, but in certain instances the wet type of the affection appears. The process may involve an entire extremity or affect merely a finger or toe. The gangrene is due to vascular contraction with stasis of the blood current and coagulation and hyaline thrombosis.

(2) *The convulsive form.* The difference in the varieties of ergotism are explained by the different actions of the constituents of the ergot and by the fact that they may act in part directly upon the blood-vessels and in part directly upon the central nervous system. In some epidemics both the gangrenous and convulsive forms have been observed but usually one has been much more prevalent than the other.

The onset of the affection is marked by anxiety and weariness, gastro-intestinal irritation, and sometimes by a slight rise in temperature. There is a sensation of formication, itching and tingling of the surface, chiefly on the fingers and toes; these manifestations are followed by numbness and local anæsthesia. Sometimes anæsthesia and hyperæsthesia are found at the same time in different parts or even in the same part; these symptoms begin in the extremities and spread thence over the whole body. The sensory disturbance may affect the digestive tract so that there may be present either voracious hunger or anorexia. At the same time there are marked weakness and depression, often with severe headache and vertigo, as well as central disturbances of the special senses, such as impairment of sight and hearing. Convulsions may follow, usually clonic in character and often epileptiform; subsequently contractures in the muscles of the limbs and sometimes in those of the trunk may develop. Formerly the disease was immediately fatal in a large proportion of patients and when recovery took place it was likely to be associated with more or less loss of intellectual power and, in some instances, with complete dementia.

Treatment. Ergotism may be wholly prevented by inspection of the rye used for flour and by destroying all suspicious grain. The treatment consists in stopping the unwholesome food and substituting that which is wholesome. The symptoms should be treated as indicated. For the muscular contractures massage, hot bathing and electricity are useful.

Pellagra is due to the use of diseased maize as a food. Not only does the affection result from eating the grain itself but it may also follow the use of products made from the corn. A ptomaine which causes analogous symptoms in animals has been extracted from the meal of diseased maize and from the fungi which affect the grain a body which will also cause the symptoms of pellagra has been isolated. Pellagra occurs in Italy, Hungary, Southern France, Spain, Mexico and Yucatan. Adults are chiefly attacked although children may also be affected. Alcoholism is believed to be a very potent

predisposing factor. Poor general condition and malaria also predispose to the affection.

Symptoms. The disease, in most instances, is first evidenced by weakness, malaise, indigestion, and pain in the head and back; sleeplessness is common and there may be mental disorder. These symptoms usually appear in winter and with the appearance of spring the typical manifestations of pellagra show themselves. These consist of an erythematous eruption which is followed by scaling and wrinkling of the skin, particularly that of parts which are not covered by clothing; the usual duration of the rash is several weeks, desquamation then takes place leaving the skin thickened and scaly. With the cutaneous symptoms there are digestive disorders such as salivation, loss of appetite, flatulence and diarrhœa. With the incidence of summer amelioration takes place but there is a recurrence of the symptoms with the following spring. The sequence of improvement in summer and relapses in the spring continues until the patient becomes affected with a chronic cachexia with which various nervous manifestations are associated; spastic paralyses of the lower limbs with atrophy and contractures occur and the deep reflexes are exaggerated. Dorsal and cephalic pain, girdle sensations and tingling and itching of the skin are observed. The special senses are impaired. Mental symptoms are common; the patient is melancholic and may attempt suicide, mania is sometimes noted and the final stage of the affection is a permanent dementia. In the protracted instances of the disease the patient has the appearance of premature old age with marked cachexia.

The prognosis as to recovery after several successive attacks is unfavorable; the course of the affection may last for 12 or 15 years.

Treatment. As a preventive measure no diseased corn should be used as food or in the manufacture of other products. A rigid inspection of all maize should be instituted and suspicious grain should be destroyed, Alcohol should be forbidden. Strychnine and quinine in large doses and especially arsenic are recommended. The symptoms referable to the motor system necessitate the employment of hot baths, massage and electricity. The affected cutaneous areas should be anointed with oily substances to prevent, if possible, the thickening and stiffening of the skin, and the itching may be relieved by the application of various antipruritics.

Lathyrism, Lupinosis or **Chick-pea Disease** is an affection due to the use as food of chick-peas or vetches, particularly the varieties *lathyrus sativus*, *lathyrus cicera* and *lathyrus clymenum*. The peas themselves cause the disease, decay being of no influence in its production. The intoxication is observed in Italy, France, Algiers and India where meal from the chick-pea is mixed with the flour of barley or wheat. Exposure to cold and wet is considered to be a predisposing factor in the causation of the affection.

Symptoms. There is sometimes a prodromal stage characterized by gastro-

intestinal irritation with gastric disturbance, diarrhœa and a rise of temperature; following this there is pain in the back and legs with tremors and weakness. Later a condition of spastic paralysis, which may continue to complete paraplegia, develops. There are no disturbances of sensation and the sphincters are rarely involved. The reflexes are increased. The arms are not affected.

Lathyrism seldom results fatally but the course of the affection is protracted and the paralysis is, as a rule, permanent.

Treatment consists in the avoidance of chick-pea meal as a food and in the employment of means calculated to relieve the symptoms. Strong counter-irritation over the lumbar region is recommended.

Atryplicism is the term applied to poisoning resulting from eating the *coast orach.* In China the *atriplex augustissima* and the *atriplex serrata* are used by the natives as food, either raw or cooked in dough. The intoxication is characterized by the appearance, within 12 to 24 hours, of numbness, coldness and tingling in the fingers and dorsa of the hands. Pruritus and œdema follow and spread to the elbow. Later the face is affected. The symptoms persist for several days and are followed by desquamation. In marked instances vesicles which may ulcerate appear and gangrene of the fingers has been observed. The resemblance of this condition to erythromelalgia has been remarked.

Treatment. The offending substance should be removed from the intestinal tract by inducing free movements of the bowels. The local manifestations may be relieved by the application of soothing lotions.

THE EFFECTS OF EXPOSURE TO HIGH TEMPERATURES.

HEAT EXHAUSTION.

Definition. A condition of prostration characterized by a tendency to syncope, vaso-motor paralysis and subnormal temperature and resulting from over-exertion under high temperature. Exposure to the direct rays of the sun is unnecessary in the production of this affection since it may be due to the influence of artificial heart, such as that of the stoke-holes of steamships. It may occur in infants during hot weather.

Symptoms. These consist of intense bodily weakness and in the more marked instances, of syncope, pallor, vertigo, impairment of vision, and coldness of the surface. There is a clammy perspiration. The unconsciousness which often results is usually followed by sleep from which the patient wakes within an hour or two in a normal condition.

In intense instances the collapse is more marked, the heart action is depressed, the perspiration continues and is accompanied by restlessness and even delirium. The temperature may fall as low as 95° F. (35° C.).

Heat exhaustion is easily differentiated from true sun-stroke by the fact that in the former condition the bodily temperature is below the normal, In an ordinary attack of fainting the drop in temperature is less extreme.

Treatment. The patient should be placed upon his back with the head only slightly, if at all, elevated. Stimulation may be administered by mouth or, if the condition necessitates its more immediate action, hypodermatically. The diffusible stimulants are to be preferred, alcohol and ammonium usually being quickly available; strychnine also may be employed. For the lowered temperature frictions should be instituted and hot-water bags or hot compresses should be applied to the body and extremities.

SUN-STROKE.

Synonyms. Thermic Fever; Insolation; Siriasis; *Coup de Soleil.*

Definition. A condition caused by exposure to extremes of heat and characterized by prostration and high fever.

Ætiology. Sun-stroke is common in the United States during the hot months among those whose occupations necessitate prolonged exposure to the rays of the sun or who are employed under shelter where the temperature is markedly high, as in the fire-rooms of steamers, bakeries, sugar refineries, laundries, etc. Soldiers on the march are frequent sufferers.

Alcoholic individuals and those of plethoric habit seem especially prone to the affection. The infectious origin of sun-stroke has been suggested upon the ground that it occurs in epidemics in certain localities and more particularly in those unaccustomed to extraordinary temperatures.

Pathology. The genesis of thermic fever is explained upon the ground that when exposed to the effects of high temperature the heat center is so affected that it cannot rid the organism of the rapidly accumulating heat. As a result of this impairment of the elimination of heat the body temperature rises. Finally the heat center becomes exhausted in its effort to control heat production or paralyzed by the action of the excessive temperature already reached; all at once the tissues begin to form heat with great rapidity, the bodily temperature suddenly rises and the organism is overwhelmed.

After death the body retains its heat for a considerable time; *rigor mortis* and decay occur rapidly and the blood seldom coagulates. There is universal venous congestion, this being particularly marked in the cerebrum and lungs. The left ventricle of the heart is contracted and the right is in a condition of dilatation. There may be parenchymatous degeneration of the liver and kidneys.

Symptoms. The initiatory manifestations are usually a sensation of intense heat, headache, vertigo, oppression and sometimes nausea, vomiting and diarrhœa. Colored vision (*chromatopsia*) may be experienced. Uncon-

sciousness with marked restlessness and even delirium may follow. The skin is flushed, hot and dry, the temperature ranges from 104° to 112° F. (40° to 44° C.) or even higher, the pulse is rapid and full, the respiration difficult and perhaps stertorous. There is pupillary dilatation in the early stages, later contraction is present. In most instances the muscles are relaxed, but twitchings or even epileptiform convulsions are sometimes observed. Perspiration may reappear as a late symptom but has no influence in lessening the height of the temperature. The urine is diminished and may contain albumin. In favorable instances a fall in the bodily temperature is accompanied by a remission of the other symptoms. Complete recovery may ensue or the patient may be left with nervous and mental disturbances varying from simple loss of memory to insanity. A common sequel is an inability to endure even slight degrees of heat; individuals possessing this idiosyncrasy may become very uncomfortable at as low a temperature as 80° F. (26.7° C.).

In fatal sun-stroke the temperature remains high, the unconsciousness becomes more profound, the heart weakens, the respiration becomes rapid and shallow and death supervenes, usually in from 12 to 36 hours. In another type of the affection the patient may die suddenly or within a short time after the onset with the symptoms of cardiac failure such as rapid and almost imperceptible pulse, marked dyspnœa and coma.

The "*continued thermic fever*," *Florida fever*," "*country fever*" *or* "*fièvre inflammatoire*" which occurs in warm and tropical climates is a continued fever which has been attributed to prolonged exposure to a high temperature although of late its septic origin has been suggested. The condition may be difficult of separation from enteric and malarial fevers.

The prognosis varies with the type of the affection; the milder instances almost invariably recover under proper treatment.

Treatment. Prevention of sun-stroke consists in the avoidance of extremes of heat and abstinence from alcohol, over-eating and over-work; plenty of water should be taken, frequent baths are advisable and the clothing should be light.

In treating thermic fever the first indication is to lower the temperature as rapidly as possible. If a bath tub is available the patient should be immersed in cool water and rubbed vigorously with lumps of ice in the hands of at least two attendants. If no tub is at hand the patient should be placed in the shade, if in the open air, and cool water should be dashed upon him. If tubbing is impossible for other reasons ice water enemata or the ice pack may be substituted for this procedure; sprinkle baths from a watering can held at a considerable height or from a hose are often beneficial, probably from the stimulation effected by the impact of the water against the body as well as from the reduction of temperature which results. The temperature should be taken at frequent intervals and when it has reached 102° F.

(38.9° C.) the hydriatic measures should be stopped, for otherwise the temperature is likely to fall to a subnormal level and collapse may result. The patient should now be put to bed, given a cathartic and catheterized if necessary; he should remain in bed and on a light diet for a few days. Subsequent rises of temperature may be controlled by cold sponging or tub baths if necessary; the coal tar antipyretics may also be employed.

Syncope may be controlled by hypodermatic injections of brandy or whiskey; æther, ammonium and strychnine may also be employed. Artificial respiration is sometimes necessary.

In the rapidly fatal instances with symptoms of asphyxia, venesection should be performed. Convulsions should be controlled by chloroform inhalations.

The treatment of the consequences of thermic fever is symptomatic.

CHAPTER IV.

DISEASES OF THE DIGESTIVE SYSTEM AND PERITONÆUM.

DISEASES OF THE MOUTH AND TONGUE.

Of the more usual forms of stomatitis, since the treatment of all is practically the same, mycotic stomatitis will be taken as a type.

MYCOTIC STOMATITIS.

Synonyms. Thrush; Parasitic Stomatitis; Sprue.

Definition. An inflammation of the buccal and pharyngeal mucous membranes characterized by whitish deposits.

Ætiology. The inflammation is due to the growth and development upon the lining of the mouth and pharynx of a fungus, the *oidium albicans* or the *saccharomyces*. Thrush occurs chiefly in nursing children and is especially predisposed to by poor physical conditions, unhealthy surroundings and the use of unclean nipples and nursing bottles.

Pathology. The *oidium albicans* grows upon the mucous membrane in the form of numerous scattered tiny grayish-white spots. These may coalesce and form areas covering, in rare instances, almost the entire buccal lining and involving the œsophagus. Around these whitish spots is a reddened areola and they are somewhat adherent to the mucous membrane but may be detached, leaving a surface intact or eroded.

Symptoms. These consist of the presence of the already described spots and of those of the accompanying physical condition. The mouth is likely to be dry and should there be any doubt about the diagnosis it can readily be assured by recourse to the microscope.

The Treatment of Stomatitis. Infants in almost all instances may be prevented from acquiring stomatitis by proper attention to the cleanliness of rubber nipples, nursing bottles, etc. The nipples should be boiled daily in a solution of washing soda and should be kept in a boric acid or sodium salicylate solution. The child's mouth should be cleansed by means of the finger wrapped about with a bit of absorbent cotton moistened with boric acid solution or a solution of baking soda. Such methods should prevent the occurrence of sprue. When the disease is present the above means should be employed and in addition the lining of the mouth should be gently painted 3 or 4 times a day with a camel's hair brush dipped in a 1 to 3 percent.

solution of silver nitrate, or a 5 percent. solution of alum. In obstinate instances it may be well to give the mouth a few days complete rest and feed through the nasal tube, at the same time employing local treatment as above.

The various forms of stomatitis in adults, including the mercurial variety, should be treated by strict attention to the hygiene of the mouth; the abuse of alcohol and tobacco should be stopped, the teeth should be frequently brushed and otherwise properly cared for. The frequent use of mildly antiseptic fluids such as liquor antisepticus, etc., is to be recommended. Tincture of myrrh is a pleasant mouth wash used in strength of 2 teaspoonsful (8.0) to the tumbler (250.0) of water and a saturated solution of potassium chlorate is also useful. The ulcers of aphthous stomatitis may be painted with 3 percent. silver nitrate solution or gently touched with the silver nitrate stick.

In the treatment of the various forms of stomatitis the general bodily condition must not be neglected. Proper food, exercise, fresh air, etc., should be advised; tonics, such as iron, nux vomica, codliver oil and the like, may be necessary.

In mecurial stomatitis the administration of the mercury should be stopped and treatment, such as that described above, instituted.

GANGRENOUS STOMATITIS.

Synonyms. Noma; Cancrum Oris.

Definition. An inflammation usually affecting the cheek at the angle of the mouth and spreading outward. It is characterized by infiltration, followed by necrosis and gangrene, of the tissues involved.

Ætiology. The disease is probably of microbic origin; it is usually seen in young children who have been brought up in unsanitary surroundings and are in poor physical condition. It is rarely primary but, as a rule, is secondary to attacks of measles, scarlatina or other acute infectious diseases.

Pathology. The process consists first of a brawny infiltration of the tissues, followed by a slowly spreading gangrene which may go on to perforation of the cheek or involvement of the jaw. Rarely does the gangrenous tissue separate spontaneously, the process usually advancing until terminated by death.

Symptoms. The first local manifestation is a dark spot upon the lip or cheek, but usually the condition is well advanced before the diagnosis is made. There is a characteristically foul breath and the odor of the sloughing surface is often very fœtid; as the disease advances the eye or ear may become involved and the neighboring lymph ganglia are enlarged. The pain of noma is usually slight.

When the disease is well established in its course the temperature is typical of sepsis, the pulse rapid and weak, and the appearance one of great prostra-

tion. There may be gastro-intestinal disturbances due to the swallowing of the discharge from the inflammatory area, or septic pneumonia due to its inhalation. The course of the disease is rapid, lasting about a week or ten days. The mortality is high, 75 percent. of infections ending fatally.

Treatment. The prophylaxis of noma consists in the proper treatment of the ordinary forms of stomatitis and attention to the condition of the mouth during the course of all infectious diseases. The neglect of this latter is inexcusable, and too great stress cannot be laid upon the necessity for the frequent use of cleansing and antiseptic solutions upon the mouths and tongues of patients suffering from scarlatina, diphtheria, measles and the other infections.

Cases of noma should be isolated and the treatment of the disease itself must, from the start, be most radical. Total excision of the inflammatory area with the knife, or cauterization by means of the Paquelin cautery are methods which have been in common use and in a combination of the two we have the most efficacious means of treatment. The excision should be performed with the patient under a general anæsthetic and it should be extended well beyond the diseased area. After excision the cautery should be applied to the edges of the wound. The use of nitric acid or scraping away the diseased tissues is not to be recommended when the more radical procedure is possible.

The treatment, otherwise than by operation, consists in stimulation as indicated, keeping the sloughing surface and the mouth cleansed by means of antiseptic solutions, such as hydrogen dioxide, potassium permanganate, etc., and instituting a nourishing diet.

The serum therapeusis of noma is as yet not upon sufficiently firm basis to be employed to the exclusion of surgical measures, although instances have been reported in which antidiphtheritic and antistreptococcus serum have been used with favorable results.

GEOGRAPHICAL TONGUE.

Synonyms. Pityriasis of the Tongue; Eczema of the Tongue.

This condition is evidenced by one or more grayish, slightly elevated spots upon the mucous membrane of the tongue. These areas may be of varying size and usually involve only the dorsum of the organ, they tend to spread peripherally, producing patches which may unite and, bounded as they are by a slightly elevated border, have given rise to the map-like appearance known as the "geographical tongue." The patches at times heal and disappear but seldom fail to recur from time to time. The symptoms are not marked, itching and burning sensations being, as a rule, all that causes the patient to complain. There may be an accompanying increase in the salivary secretion.

Treatment. The disease is not of malignant character although it is difficult of treatment. The general condition, and especially the digestion of the patient, should be looked to and proper diet and mode of life insisted upon. Tonics are useful in enfeebled conditions. Arsenic may be given and the use of astringent and antiseptic applications is indicated. Silver nitrate (3 percent.), chromic acid (1 percent.) and weak iodine solutions may be applied by means of a brush, and mouth washes of weak boric acid solution or tincture of myrrh may be employed.

An ointment of boric acid and balsam of Peru in vaseline has been recommended, and Unna advises applications of sulphur, either in the form of a natural water containing this substance, or, preferably, in his opinion, washed sulphur in an emulsion.

LEUCOPLAKIA BUCCALIS.

Synonyms. Lingual Ichthyosis; Lingual Psoriasis; Leucoplasia; Smoker's Tongue; Chronic Superficial Glossitis.

Definition. A disease of the mucous membrane lining the mouth characterized by whitish patches of irregular size, which at times are thickened and tend to fissure.

Ætiology. The actual causation of this condition is not known; while it has been ascribed to syphilitic disease it has been known to occur in non-luetic individuals; the existence of mercurial stomatitis, excessive smoking, uncleanly buccal and dental conditions and gastro-intestinal diseases seem to be predisposing factors. Leucoplakia is most often seen in males beyond middle-life, and is said to predispose to epithelioma.

Symptoms. The first indication of the disease is a hardly noticeable reddish or bluish patch, which may be sensitive to hot or irritating foods. Very slowly and gradually the reddish spot develops into a rounded or irregular patch, whitish or pearly in color. Several of these, while small at their inception, may coalesce as they increase in size. The affected areas become thickened and stiff, have a hard surface and may become fissured. The dorsum of the tongue is most usually the site of the lesion but it may occur upon other parts of this organ, upon the lining of the cheeks or even upon the lips.

Treatment consists in establishing a cleanly condition of the mouth, stopping the use of tobacco, and proper care of the teeth. Antiseptic and astringent mouth washes are indicated and the patches should be touched with a 10 percent. silver nitrate solution, or better with the lunar caustic, once every ten days or so. The galvano-cautery has been used with benefit as also has a 20 percent. solution of pure chromic acid. A paste consisting of resorcinol 4 parts, zinc oxide 1 part, benzoated lard to 8 parts applied to the plaques will cause them to exfoliate and is recommended by certain dermatologists.

Syphilitic treatment accomplishes little in the treatment of leucoplakia buccalis proper but when the diagnosis is in doubt the employment of mercury and the iodides is indicated. Treatment calculated to correct any accompanying digestive or assimilative disorder which may be present should benefit the buccal condition.

DISEASES OF THE SALIVARY GLANDS.

PTYALISM.

Ptyalism or increased secretion of the saliva occurs as a symptom in poisoning by mercury, iodine, gold and copper. It may also be produced by jaborandi, muscarine and tobacco. Excessive salivary secretion is often a symptom of various forms of stomatitis and in children may occur as a neurosis.

The treatment consists in the proper management of the ætiologic condition, if due to stomatitis, and in the stopping of whatever drug may be causative of the disturbance, together with measures calculated to remove whatever of the substance may be retained in the system. Such are the administration of saline purges if the salivation be due to mercury, or sodium bicarbonate if it be the result of iodism. Mouth washes, such as a saturated solution of potassium chlorate, are useful and atropine may be given with a view to the diminution of the activity of the salivary glands.

DRY MOUTH.

This condition, sometimes also called *xerostomia*, is usually seen in febrile conditions but may occur independently. It is met most frequently in hysterical women and may appear after nervous shock. The symptoms are dryness of the mouth and a smooth, shining condition of its mucous membranes which are redder than normal in color.

The treatment is that of the nervous condition, as a result of which the xerostomia has appeared, and the use of mouth washes containing lemon juice.

ACUTE PAROTITIS.

Infectious parotitis has been discussed in the section upon the infectious diseases.

Inflammation of the parotid gland, other than mumps, may occur as a complication of the acute infectious diseases (especially typhoid fever), pneumonia, pyæmia and syphilitic disease; associated with diseases or injuries of the pelvic or abdominal viscera or genital organs; accompanying neuritis of the facial nerve and in poisoning by sulphuric acid. The inflammation is usually the result of microbic infection which may be transmitted through

the blood current or directly through the duct of the gland. The parotitis accompanying facial neuritis is in all probability the result of some vaso-motor abnormality. The symptoms of the condition are localized pain, tenderness and swelling. The salivary secretion may be increased. Abscess formation may ensue with an accompanying temperature of septic type and increased pain and prostration.

Treatment consists in the attempt to prevent abscess formation by means of leeches, the ice compress or coil. The coal tar analgesics, especially antipyrine salicylate (salipyrine) may be given to relieve the pain and aconite may be administered unless the circulation is depressed by the causative infection. As soon as abscess formation is evident an incision should be made and the pus evacuated. Chronic or subacute inflammations of the gland, which may occur as accompaniments of mercurial or lead poisoning, in syphilis, or following acute inflammations, should be treated by inunctions of blue ointment, 10 percent. ichthyol in vaseline, compound iodine or iodine-vasogen ointment.

LUDWIG'S ANGINA.

Synonyms. Angina Ludovici; Cellulitis of the Neck.

This condition is an inflammation of the floor of the mouth beginning in or about the submaxillary gland. It begins usually on one side, later spreading to the other, and is usually a complication of one of the acute infectious diseases; rarely it may be primary. It is a pyogenic infection and spreads through the tissues of the floor of the mouth and the throat. Sloughing of the soft parts or abscess formation may follow; in rare instances spontaneous resolution may take place.

The symptoms are pain, tenderness and swelling in the floor of the mouth, later in the neck, and dyspnœa if the larynx or trachea is pressed upon by the tumor. Œdema of the glottis may occur. The abscess may point either externally or internally and the constitutional symptoms are those of pus infection in general. The treatment consists in the early application of leeches or cold in the form of compresses or the ice coil.

Surgical measures are likely to be sooner or later necessary and consist in free incision and evacuation of the pus.

DISEASES OF THE TONSILS AND PHARYNX.

ACUTE CATARRHAL PHARYNGITIS.

Synonyms. Angina; Sore Throat.

Definition. A catarrhal inflammation of the mucous membrane lining the pharynx.

Ætiology. Certain persons appear to have a predisposition to frequent

attacks of sore throat. The exciting cause is usually exposure to cold and dampness, although the condition may be caused by the inhalation of irritating dust or vapors. The inflammation often occurs in individuals of gouty or rheumatic tendency, and is frequently associated with acute inflammations of the nasal mucous membrane and tonsils.

Pathology. As in all acute inflammations of mucous membranes, the pharyngeal lining and the uvula are at first dry, congested and swollen; after a number of hours or a day or two there is an excessive secretion of mucus which may be either thin and watery or thick and viscid.

Symptoms. There is usually a considerable rise in temperature, preceded by chilly feelings and general pains; the local symptoms consist first of a dryness of the throat, with discomfort or actual pain on swallowing. If the inflammation involves the larynx or Eustachian tubes there will be hoarseness and slight cough, or fulness in the head and varying degrees of impairment of the hearing. On examination the throat is seen to be red and swollen; or covered by the excess of mucous secretion. Accompanying the inflammation various tonsillar conditions may be observed.

Treatment. If seen early the patient should be given a Dover's powder, his bowels should be freely opened by repeated small doses of calomel ($\frac{1}{4}$ to $\frac{1}{2}$ a grain—0.016 to 0.032) followed by a saline and he should be put to bed. The general bodily pain may be relieved by antipyrine salicylate (salipyrine) in doses of 10 grains (0.66) every 2 or 3 hours until efficacious. This drug will have in addition an antipyretic effect and the fact that it contains the salicyl radical makes it especially advantageous in rheumatic patients. Phenyl salicylate in doses of 5 to 10 grains (0.33 to 0.66) every 3 or 4 hours and salicin are also useful in this connection.

Aconite is of use in controlling the fever and also benefits the local condition. The tincture may be given in 4 minim (0.25) doses every hour or two or $\frac{1}{400}$ of a grain (0.00016) of aconitine may be administered every 4 hours. These drugs should be stopped as soon as their physiological effect is evident, as manifested by numbness and tingling of the fauces.

The pain in the throat may be lessened by the application of frequently changed hot or cold compresses, flax seed poultices or, in severe instances, by a mild mustard paste. The pharyngeal discomfort and the local inflammation are amenable to treatment by various means such as tablets to be dissolved in the mouth, gargles, direct applications and sprays. Tablets. ℞, potassii chloratis gr. xv (1.0), olei menthæ piperitæ ♏ iii (0.20), extracti krameriæ gr. xv (1.0), extracti glycyrrhizæ ℥iss (6.0); fiat massa et div. in trochiscos no. xxx. ℞, codeinæ gr. iii (0.20), extracti gambir gr. xx (1.33), extracti glycyrrhizæ ℥iss (6.0); massa fiat et div. in trochiscos no. xx. ℞, cocainæ hydrochloridi gr. $\frac{1}{80}$ (0.002), antipyrinæ gr. ii (0.12), sacchari lactis et aquæ destillatæ q. s., fiat tales trochiscos no. xx. ℞, ammonii hydrochloridi gr. xx

(1.33), pulveris ipecacuanhæ gr. i (0.065), pulveris capsici gr ¼ (0.015), extracti glycyrrhizæ ℥ii (8.0); massa fiat et div. in trochiscos no. xx; of any of the foregoing tablets one may be dissolved in the mouth every 2 or 3 hours. The first formula is indicated in moderate pharyngeal inflammations, the second and third, when pain and irritating cough are present and the fourth, when the pharynx is covered with thick and tenacious secretion.

Small pieces of cracked ice held and allowed to dissolve in the mouth are agreeable when the pharynx is dry and painful.

Gargles are unsatisfactory as it is very difficult to reach with them the site of the inflammation but they may be used by patients to whom the atomizer spray is disagreeable. Various sprays may be prescribed.

The following will be found useful; potassium chlorate 5 grains (0.33); alum 5 grains (0.33); tannic acid 5 grains (0.33) or tincture of iron chloride 10 drops (0.66) to the ounce (30.0) of water.

Direct applications by means of a camel's hair brush of (*a*) equal parts of glycerin and tincture of iron chloride, (*b*) glycerole of tannin or (*c*) silver nitrate 10 to 15 parts to 480 of water, may be employed.

In the severe instances quick relief will usually follow the use of astringent sprays of which any of the following is applicable; zinc chloride or zinc sulphate 1 part to 24 of liquor antisepticus; iron and ammonium sulphate 6 parts, glycerite of tannic acid 6 parts; or silver nitrate 1 part to 48 parts of water. These may be sprayed into the throat by means of an ordinary atomizer, first having cleansed the parts of mucus by means of an alkaline solution such as dilute liquor antisepticus, every hour or two during the acute stage of the inflammation, the intervals being lengthened as recovery progresses.

Sprays of oily solutions such as oil of sandal wood 1 part or eucalyptol 2 parts to 100 parts of liquid albolene are often soothing to the dry and irritable throat.

An important adjunct to the management of acute pharyngitis is the proper treatment of accompanying nasal, tonsillar or laryngeal inflammations.

ACUTE FOLLICULAR TONSILLITIS.

Synonyms. Acute Lacunar Tonsillitis; Angina Follicularis; Ulcerative Tonsillitis.

Definition. An acute exudative inflammation characterized by the appearance of whitish-yellow spots upon tonsils.

Ætiology. The direct cause of this condition is doubtless a microbic infection probably due to one of the commoner pyogenic bacteria. It is prone to attack the enlarged tonsil, and the exciting cause is usually undue exposure. Some persons seem predisposed to this disease. It is frequently seen in children.

Pathology. The tonsils are red, congested and swollen; their crypts are filled with plugs consisting of mucus, pus, epithelium and bacteria. There is no true ulceration but occasionally one or more of the tonsillar crypts becomes the seat of a small abscess.

Symptoms. These resemble so closely those of a severe acute pharyngitis that they hardly need separate description. The prostration is apt to be marked and, especially in children unless the throat is carefully examined, the condition is likely to be mistaken for some more serious condition. Examination of the throat reveals swollen, red and congested tonsils and pharynx and the presence upon the former of the characteristic spots. The differential diagnosis from true diphtheria is often impossible without bacterial examination. General bodily pains and a febrile movement are, as a rule, present.

Treatment. When spots are seen upon the tonsils of children it is always wise to give diphtheria antitoxin in therapeutic dosage without waiting for a bacterial examination of the exudate, otherwise valuable time may be lost. The constitutional treatment of the condition otherwise is practically that of an acute pharyngitis.

The application to the outside of the throat of the local measures described upon p. 339 is also in order.

With regard to local applications the use of an antiseptic spray of Dobell's solution or of liquor antisepticus and water is excellent; in addition the tonsils should be painted with some astringent or antiseptic such as Monsell's solution, tincture of iron chloride, tincture of iodine, or 1 to 1000 mercury bichloride solution.

As an adjunct to the above treatment one to two drachms (4.0 to 8.0) each (for an adult) of tincture of iron chloride and glycerin should be slowly swallowed every hour or two so that the mixture may come into contact with the diseased surface and the patient may dissolve in his mouth every 3 or 4 hours a pastille containing $\frac{1}{30}$ of a grain (0.002) of thymol, $\frac{1}{3}$ of a grain (0.02) of sodium benzoate and $\frac{1}{4}$ of a grain (0.016) of saccharin. One of these is kept in the mouth until it has lost its taste. It is then removed, since by this time the saliva has become so impregnated with the medicaments which it contains that in swallowing, these come in contact with the seat of the inflammation.

When adenoids and hypertrophy of the tonsils exist the removal of these as a prophylactic measure is strongly to be advised. It is needless to say that the operation should not be done during the acuity of the inflammation.

Important also is attention to the general condition of patients disposed to tonsillar inflammations. Proper hygiene, diet and tonic treatment are indicated. The exhibition of codliver oil and the syrup of iron iodide is especially to be commended in this connection.

QUINSY SORE THROAT.

Synonyms. Peritonsillar Abscess; Phlegmonous Tonsillitis; Acute Parenchymatous Tonsillitis.

Definition. An acute suppurative inflammation of the tonsillar or peritonsillar tissue.

Ætiology. The causes of this condition are practically identical with those of acute follicular tonsillitis. It is seldom seen in children or persons beyond middle life. Its actual cause is pyogenic germ infection but attacks are often excited by exposure, and it is frequent in individuals possessing hypertrophied tonsils.

Pathology. One or both tonsils may be affected; they become swollen, red, painful and tender and if pus formation occurs the induration gradually becomes less marked and an abscess supervenes which, unless opened, may rupture and discharge its contents. The lymph glands of the neck are often enlarged and tender.

Symptoms. The disease is usually ushered in by a chill followed by a marked rise in temperature, general pains and prostration. There is pain in the throat, increased by swallowing and by opening the mouth. There is tenderness over the angle of the jaw and in the neck. The voice becomes nasal, the secretion of saliva is increased and the pain caused by swallowing may result in dribbling from the mouth. Bad odor upon the breath and of the saliva is not infrequent. The swelling of the pharynx may cause difficulty in breathing; the pulse is rapid and bounding and the temperature curve is likely to be of septic type. These symptoms last several days until the abscess forms and bursts or is relieved by incision. Under proper treatment the prognosis is good. Frequent palpation of the seat of the inflammation should be made to determine the presence of pus.

Treatment. Prophylaxis consists in the removal of hypertrophied tonsils and attention to nasal or pharyngeal conditions. If there is any rheumatic tendency it should be combated by the administration of the salicylates. At the beginning of the attack the patient should be put to bed and his bowels freely opened by means of repeated small doses of calomel followed by a saline. The diet should be of fluids. If seen early, an attempt to abort may be made by means of the administration of sodium salicylate 10 grains (0.66) every hour until physiological effect has become apparent, tincture of aconite one minim every hour until 4 doses have been taken and a single dose of 10 grains (0.66) of quinine with one (0.065) of opium. These measures may succeed if instituted early in the inflammation.

The pain and discomfort may be mitigated by the local application of 5 to 10 percent. cocaine solution, by frequent application by means of the finger to the tonsil of sodium bicarbonate and by the external use of cata-

plasma kaolini, hot water bags or hot compresses. Gargling the throat with as hot water as can be borne, the use of alkaline and antiseptic sprays and inhalations of steam may also relieve the patient's discomfort. Local blood-letting by means of punctures (never scarification) with a slender sharp pointed knife will relieve the tension and reduce the inflammation.

The tonsils should be frequently felt by the physician and as soon as fluctuation is manifest the abscess cavity should be freely incised in the *vertical* direction over the point of maximum fluctuation and the pus evacuated. After incision the use of antiseptic gargles and sprays should be continued until all inflammation has subsided.

In rare instances where the dyspnœa due to the swelling of the pharynx and consequent closure of its opening is extreme, tracheotomy may become necessary.

DISEASES OF THE ŒSOPHAGUS.

ACUTE ŒSOPHAGITIS.

Definition. An acute inflammation of the œsophageal mucosa and submucosa, rarely involving the muscular coats.

Ætiology. Acute œsophageal inflammation is usually the result of the swallowing of caustic or very hot liquids or of the presence of foreign bodies. The eruptions of the various exanthemata may involve the œsophageal mucous membrane and inflammations of the throat may spread downward to this structure.

Pathology. There is more or less redness of the œsophageal lining and there may be sloughing and destruction of tissue, depending upon the cause of the lesion; hollow casts consisting of the entire lining of the organ have been given off following the ingestion of corrosive acids or alkalies. As healing progresses the newly formed scar tissue may contract and produce stenoses of varying degree.

Symptoms. These vary with the degree of the inflammation. They consist of pain under the sternum which is increased upon deglutition, sometimes to such an extent as to render this process impossible. There may be profuse secretion of mucus, which may be either raised or swallowed, from the inflamed surface. Should the action of the cause of the lesion be sufficient to erode the vessel walls there will be regurgitation of blood or this will appear in the stools. The resulting stenosis interferes with swallowing.

Treatment. This consists in putting the part as much at rest as possible. If the patient is able to swallow liquids only, these should be of the most soothing character, such as milk or arrowroot or other cereal gruels. The various demulcents or the swallowing of cracked ice afford relief to the pain.

When swallowing is impossible-the patient must be fed by the rectum.

CHRONIC CATARRHAL ŒSOPHAGITIS.

This condition may exist as a complication of chronic endocarditis, cirrhosis of the liver or other affections which result in venous stasis. The œsophageal mucous membrane is the seat of a chronic catarrhal inflammation with hypersecretion of mucus. The veins of the part may become dilated and tortuous and may rupture with consequent regurgitation of blood.

The treatment of this affection consists in the proper management of the causative condition.

ŒSOPHAGEAL SPASM.

Synonym. Œsophagismus.

Ætiology. This affection is usually seen in persons of neurotic or hypochondriacal temperament of either sex. It may also occur in insanity, epilepsy, chorea and other nervous diseases.

Symptoms. The spasm is brought on by the attempt to swallow or by the thought of this act. There is no history of any condition which might have caused a stricture yet the patient complains of difficulty in swallowing and sometimes of painful deglutition. The condition does not get worse as it usually does in true stricture and there is equal difficulty in swallowing fluids and solids; in instances of long duration, above the seat of the spasm a dilatation may develop with a consequent catarrhal œsophagitis. There is usually loss of flesh and strength.

Treatment. This is usually efficacious and consists, in addition to the proper managing of the neurotic condition of the patient by means of sedatives, tonics, diet and regulation of the mode of life, in the passage of the stomach tube or œsophageal bougie. This should be done slowly and gently. The instrument should be passed into the œsophagus until it reaches the seat of the spasm. Here it should be held and upon it very gentle pressure should be exerted, suddenly the spasm will give way and the bougie or tube will pass through. This should be done once or twice a day. In conjunction with the passage of the tube it is often well to wash the stomach and introduce fluid food.

CANCER OF THE ŒSOPHAGUS.

Cancer of the œsophagus is usually of the epithelial type beginning in the wall of the organ and gradually surrounding it; the growth develops in hard masses which may or may not ulcerate, and usually causes a stenosis, above which dilatation is likely to take place. The cancerous process may involve any portion of the tube but is slightly more frequent in its lower portion. It may extend to the adjoining structures and metastases may be set up in the various viscera; œsophageal cancer is rarely seen before middle life.

Symptoms. The first of these to attract notice is dysphagia; at first it occurs with solid food only, later liquids are swallowed with difficulty and finally complete œsophageal obstruction may develop. The difficulty in swallowing is accompanied by the regurgitation of food. There is often pain referred to the œsophageal or sternal region; this is especially marked when the patient swallows and may be present when the œsophagus is at rest. As the disease progresses the typical cancerous cachexia appears and its advancement may be rapid because of the difficulty of getting sufficient food into the patient's stomach. Examination by the œsophageal bougie reveals the presence of an obstruction and may cause slight hæmorrhage.

Treatment consists in the employment of means to prolong the patient's life. He should be fed by the mouth as long as he is able to swallow and afterward rectal feeding must be employed. The obstruction may be retarded in its tendency to cause stenosis by the gentle passage of a stomach tube from time to time. Gastrostomy may be performed and the patient's life prolonged by making a permanent gastric fistula through which he may be fed. Other surgical measures are of little avail. The use of radium has been exploited and is worthy of trial. The metal may be enclosed in a tube attached to a flexible bougie and exposure made by passing the same to the site of the lesion.

BENIGN STRICTURE OF THE ŒSOPHAGUS.

Ætiology. This condition is rarely congenital. More frequently is it acquired. Its most usual cause is cicatricial contraction following ulcers which may have resulted from the ingestion of escharotic substances or from syphilis. The œsophagus may also be narrowed as a result of pressure of tumors extraneous to it, such as enlarged mediastinal glands or new growths, aneurysms, etc., and as a result of tumors having their origin in its wall.

Symptoms. The symptoms of non-malignant stricture of the œsophagus are those of stenosis, difficulty in swallowing of greater or less degree, and regurgitation. Pain is sometimes present. Above the stricture there is usually dilatation.

Treatment consists in the gradual dilation of the stricture by means of bougies. If cancer is present this must be done with great care. The situation of the lesion should be determined by the passage of one of these instruments and then, by using sizes successively smaller, the calibre of the opening is ascertained. When this has been done the stricture is dilated by passing as large an instrument as is possible without causing too much pain. At successive sittings the bougies used may be of larger and larger sizes. Certain strictures may be of such small diameter that no bougie can be passed, in which case rectal feeding must be prescribed and surgical procedures are necessary. These consist of the making of a permanent gastric fistula through

which the patient may be fed, or the performance of various operations upon either the œsophagus itself or upon the extraneous lesions which by their pressure cause the obstruction.

DILATATIONS OF THE ŒSOPHAGUS.

These may be either fusiform, involving the whole circumference of the organ, or sacculated, involving only a portion of its periphery.

The former variety is usually secondary to stricture although rarely it may occur idiopathically. It may involve the whole length of the tube or only a portion. Its diameter is frequently greatest at its lowest part; the wall of the tube is thickened and at times its muscular coat is paralyzed.

Sacculated dilatations or diverticula are of two varieties, (1) those due to contraction of some tissue which as a result of inflammation has become adherent to the œsophagus; these are more frequent in children, are usually small and may be multiple. (2) The second variety is usually seen in adults, is found in the upper part of the tube where its wall is weakest and is due to pressure, exerted by boluses of food, which are too large, or to traumatism, such as the lodgment of a bone. Such diverticula involve the posterior wall.

Symptoms. Those of the fusiform dilatations are dysphagia, regurgitation of food and at times vomiting. The patient may complain that, though a considerable quantity of food is eaten, there is a sensation as if very little reached the stomach.

The diverticula due to contraction are usually without symptoms but those due to pressure cause difficulty in swallowing and, as the sacs become larger and catch the food swallowed, this is regurgitated. At times there is a foul odor upon the breath due to the decay of food retained in the sac. This form of dilatation tends to increase in size and, as the enlargement progresses, it may press upon the œsophagus and cause occlusion. As the difficulty in getting food into the patient's stomach increases he loses flesh and strength and may finally die from starvation. The diagnosis of the condition is made by the use of the bougie and it must be carefully differentiated from stricture without dilatation. This may be done by passing one instrument into the sac and another into the stomach. At times it may be difficult to pass a sound into the diverticulum, but this may be more readily accomplished by the use of a specially constructed sound slightly bent at its end.

Treatment consists in the dilation of the stricture, if it is present, and by feeding through the stomach tube. Rectal feeding may be found useful as an adjunct to other means. Surgical measures, such as the formation of a permanent gastric fistula, the relief of the causative stenosis by various operative procedures or the removal of the diverticula, may be employed as indicated.

DISEASES OF THE STOMACH.

ACUTE CATARRHAL GASTRITIS.

Synonyms. Acute Gastric Catarrh; Gastric Fever; Acute Dyspepsia.

Definition. An acute catarrhal inflammation of the mucous membrane lining the stomach due to simple irritation or occurring as a result of the presence of the products of decomposing or fermenting food.

Ætiology. The disease may follow interference with the hepatic function, it may be caused by exposure or it may complicate any of the acute infectious diseases. The most usual causes, however, are over-loading the stomach with indigestible or highly seasoned foods or the excessive drinking of alcoholic beverages.

Pathology. The gastric mucous membrane becomes first congested and swollen and its secretions are diminished. Later the mucous secretion is increased in quantity and there may be an exudation of serum and emigration of white blood cells. More rarely there may be small hæmorrhagic spots or hæmorrhagic erosions upon the gastric lining.

Symptoms. The principal symptoms are lack of appetite, nausea, usually followed by vomiting, which may bring relief to the patient, bad taste in the mouth headache, dizziness and general physical and mental depression. Pain of greater or less degree may be present.

The lips and mouth are dry, the tongue is coated and palpation of the stomach may reveal indistinctly localized tenderness and distention of the organ involved. There are eructations of gas and of acid or bitter matter. The vomiting may be frequent and the patient sometimes is unable to keep anything in the stomach. The bowels are usually constipated, though diarrhœa is at times observed. The skin and conjunctivæ may be jaundiced as a result of an accompanying duodenitis. There may be a moderate febrile movement, but elevation of temperature is not a feature of this disease. With the fever the pulse is accelerated. The urine is scanty and highly colored and usually contains urates in excess. Indicanuria is not infrequent. An attack of acute gastritis usually lasts from two to four days.

The stomach contents, either the matter vomited or the result of a test-meal, shows an abnormal increase in mucus, a diminution in the total acidity and a lack of free hydrochloric acid. Lactic, butyric, acetic acids and bile are often present. The food is only partially digested and frequently appears to have been little changed since it left the mouth.

Treatment. In persons susceptible to attacks of acute gastritis much may be done in the way of prevention by the wearing of proper clothing. Constriction of the region of the stomach by improperly fitting or too tightly laced corsets and especially the suspension of garments from the waist often predisposes to gastric attacks in women and consequently these practices

should be inveighed against. Chilling of the abdomen is likely to bring on an attack, and to provide against this, snugly fitting garments, sufficiently warm in texture and preferably not open below, should be worn.

Dietetic prophylaxis consists in the avoidance of indigestible or highly seasoned foods and especially those which may be adulterated with chemical substances. The practice of food-adulteration is becoming all too common; coloring matters and preservatives are frequently introduced and these substances are prone to disturb the susceptible stomach. Not only must the quality of the ingested food be supervised but care should be exercised against over-loading the stomach, the teeth must be kept in good condition and the patient advised concerning proper mastication and insalivation.

The treatment of the attack proper consists in insuring as complete rest as possible for the organ involved, consequently it is wise to give as little food and drink as possible until the gastric irritability has disappeared. There is no reason why the patient suffering from acute gastritis should not fast for a day or more, even though there is a sustained prejudice amongst the laity against the practice. When excessive thirst is present the mouth may be rinsed with cool water, which should not be swallowed, or cracked ice may be sucked. A little dry champagne, a weak solution of hydrochloric acid, carbonated waters, or cold tea without sugar may be employed in checking thirst, but it is important that very little fluid of any sort should be taken at a time.

After the day's fast the first food to be allowed is milk; this may be diluted with a little lime water or Vichy, peptonized or boiled, and but a small quantity should be given at a time. Beef or chicken broth containing egg or rice may follow and on the third day zwieback or soda biscuit may be given. By the fourth day the tolerance of the stomach and the patient's hunger will have so increased that a return to a more general diet will be necessary and such foods as calf's brain boiled in bouillon and broiled, broiled chicken or squab, broiled sweetbreads and veal boiled in bouillon may be given; potato purée soup, scraped beef, scraped ham, stewed ripe fruit, tapioca, rice and eggs, soft boiled, scrambled or as omelet may be added by the sixth day.

On the second day of the attack it is wise to administer calomel either in six quarter grain (0.016) doses, one every half hour, or better in two large doses of 5 grains (0.33) one at night, the other in the morning. By this means any irritating substance which may have gotten beyond the pylorus will be prevented from doing further harm and any accompanying constipation will be relieved. The frequent vomiting of the first day will usually interfere with any medication by mouth, even were it necessary. This vomiting as a rule empties the stomach effectually but should this not be the case and should the emesis persist beyond the endurance of the patient, gastric lavage with

warm water by means of the stomach tube should be employed. In children it is particularly beneficial. Here a soft rubber catheter of appropriate size must be used and, while its eye may be too small to allow the admission of the larger food particles, its introduction will induce vomiting and the wash water poured through it will cleanse the stomach. During the lavage the patient should be directed to change his position, standing erect, then lying on the back and each of his sides in succession. Changes of position are easily made in the case of children but in the adult unaccustomed to the tube it will be found more difficult. The object of assuming different postures is to permit the lavage to cleanse every portion of the stomach. A drachm (4.0) of sodium bicarbonate added to each quart (litre) of the water used will assist in dissolving the mucus from the gastric lining. When the water returns clear a final washing with a disinfectant solution of thymol 8 grains (0.5), boric acid ½ ounce (15.0) to the quart (litre) of water is advisable. As a substitute for washing the stomach copious draughts of warm water may be taken and emesis induced by applying the finger to the pharynx. The use of emetic drugs is considered inadvisable by most gastrologists because of the depression and increased gastric irritation which they produce. However one may, if necessary, give a drachm (4.0) of syrup of ipecac to a child; in the adult the hypodermatic use of apomorphine hydrochloride $\frac{1}{12}$ of a grain (0.005) is to be preferred to ipecac or antimony.

A few hours after the stomach has been cleansed the high colonic irrigation consisting of a gallon (4 litres) of warm—105–110° F. (40.5–43.3° C.)—half saturated boric acid solution should be given in order to remove any irritating substance which may be present; in asthenic patients this procedure acts also as a stimulant of considerable value.

Very persistent vomiting is extremely exhausting to the patient and when not relieved by emptying the stomach by lavage, may be controlled by bismuth and cocaine in combination.

In rare instances weakness and tendency to collapse occur and may be combated by small doses, ½ to 1 drachm (2.0 to 4.0), of iced champagne or brandy and cracked ice repeated as indicated.

Pain or feeling of oppression in the abdomen may be relieved by hot or cold applications or turpentine stupes. When fever is present the cold are to be preferred; if the patient is chilly the hot are indicated.

The use of morphine hypodermatically for the pain is not to be recommended except under exceptional circumstances. In all ordinary instances this symptom may be controlled by codeine by mouth or combined with belladonna in suppositories containing each a quarter of a grain (0.016) of codeine and an equal quantity of extract of belladonna. One of these may be used every 2 or 3 hours until the pain is eased.

Codeine by mouth may be given in tablet form or in solution. Quarter

to half grain (0.016 to 0.03) doses may be taken every 3 hours. This drug may also be administered hypodermatically with good effect.

Following an attack of acute gastritis the appetite may be poor; in such a contingency the bitter tonics, condurango, rhubarb, etc., may be given, either alone or with dilute hydrochloric acid, to supply the lack of this substance in the stomach. Ten drops of the dilute acid (0.66) may be given in a glass of water before or during meals. The following prescription is also useful in this connection and when there is need of a general tonic. ℞ strychninæ sulphatis, gr. ss (0.03), acidi hydrochlorici diluti, ʒss (15.0), fluidextracti condurango, ʒvi (25.0), syrupi aurantii corticis q.s. ad ʒiv (120.0). Misce et signa, one teaspoonful in a wine glass of water ½ hour before each meal.

It should be remembered that mixtures containing hydrochloric acid should be taken through a tube in order to prevent corrosion of the teeth.

CHRONIC CATARRHAL GASTRITIS.

Synonyms. Chronic Catarrh of the Stomach; Chronic Dyspepsia; Chronic Gastric Catarrh.

Definition. A chronic catarrhal inflammation of the mucous membrane of the stomach, usually associated with the hypersecretion of mucus and abnormalities of the digestive elements of the gastric secretions.

Ætiology. This condition may result from repeated attacks of acute gastritis or the complicating gastritis of the infectious diseases. It follows the continued ingestion of too much or improper food or the abuse of medicines, tobacco and alcoholic drinks. Conditions which interfere with the proper blood supply of the organ, such as chronic endocarditis, cirrhosis of the liver, chronic pulmonary disease and chronic nephritis, often produce this affection.

Pathology. The mucous lining of the stomach is swollen and congested, it is grayish or brownish in color, may be ridged and usually is covered with a viscid alkaline mucus. The peptic glands are first increased in size, finally degenerate and become atrophic. The supporting connective tissue stroma may be in a state of hyperplasia. In marked instances the glands may be obliterated by this over-growth of tissue. These changes may involve the entire gastric mucosa or a limited portion of this structure.

Symptoms. Pain is a frequent symptom and varies from a sense of discomfort or fulness referred to the stomach to marked distress. Tenderness may be present; it is, as a rule, diffuse. The appetite is diminished or lost and even the thought of food may disgust the patient. There is an unpleasant taste in the mouth, a coated tongue, nausea and oftentimes vomiting. The

vomitus consists of mucus and undigested food with, rarely, a little blood. Its reaction may be acid or not; when the former is the case the acidity is not due to the presence of the normal hydrochloric acid of the stomach but to that of lactic, butyric and acetic acids, resulting from the fermentation of the undigested food. The eructation of gas is a frequent symptom. In the alcoholic type of the disease early morning vomiting of mucus—the so-called water brash—is frequent. The bowels are likely to be constipated.

The urine is scanty, high colored and contains phosphates or urates in excess. Indicanuria and oxaluria may at times be observed.

The patient complains of headache and dizziness and loses flesh as a consequence of the lack of proper digestion and assimilation, he sleeps poorly and may be melancholic. A febrile movement is not a characteristic of this disease and the pulse rate is variable. Reflex dyspnœa and palpitation may be present.

The so-called stomach cough is probably not due to any gastric condition but is much more likely to be due to pulmonary tuberculosis and the clinician should always be on the lookout for beginning apical lesions when indefinite stomach symptoms are described. Many such instances are treated by the gastrologist to the great detriment of the patient.

The course of chronic gastric catarrh is long and complete recovery hardly to be expected. The symptoms can, however, be held in abeyance by proper diet and treatment and the patient's usefulness and enjoyment of life may continue with little impairment.

The Stomach Contents. The quantity withdrawn after a test-meal is usually considerable and much mucus is present unless there is total atrophy of the glandular coat. The hydrochloric acid and pepsin are deficient and in instances of glandular atrophy there may be total achylia. Bacteria, a few blood cells, sarcinæ and epithelial cells are often seen. Usually a number of test-meal examinations must be made before the true state of the patient can be determined with certainty.

Treatment. Prophylaxis consists in the avoidance of the errors in diet and mode of life that are likely to cause this condition. The food should be of proper quality and quantity, it should be eaten at regular intervals, and slowly and thoroughly masticated. Excessively hot or cold fluids should not be drunk and the abuse of alcoholic beverages and tobacco must be avoided. Proper attention should be paid to the care of the teeth and, where these are beyond repair, artificial ones should be provided. The use of the tooth-brush after every meal should be advised, together with the removal of all food particles from between the teeth by means of a wooden tooth-pick or dental silk. The mouth should also be rinsed after eating with a suitable wash such as equal parts of hydrogen dioxide, liquor antisepticus, lime water and water.

Conditions of the heart, liver or kidneys to which gastric congestion is often secondary should be carefully treated. In cardiac lesions, when compensation is likely to become disturbed, digitalis, either alone or in combination with strychnine, should be prescribed. The digitalis is unlikely to disturb the gastric function and under its use the congestion disappears, and the appetite and general condition improve. If the drug disturbs the stomach it may be given *per rectum*, in the form of the infusion, or hypodermatically.

Lavage. By this means we are able to remove from the stomach the excessive accumulation of mucus with which it is burdened and to relieve the organ of its retained content of fermenting food. It is the mode of treatment *par excellence* in gastritis with excessive mucus production and muscular atony. In this form of the inflammation frequent washings are necessary, while in atrophic gastritis with little production of mucus the procedure need not be undertaken so often. In mucous gastritis the frequency of the lavage depends upon the state of the gastric inflammation, but usually once a day is sufficient. In marked instances with large quantities of mucus and advanced atony lavage before breakfast and in the evening may be necessary. The most favorable time for stomach-washing is in the evening before supper, since at this time the stomach has been quiet since the noon meal—which in these patients should be the principal one—and the supper to be taken afterward will as a rule be light. The tube having been passed, the mucus may be removed, allowing the water to run in under considerable pressure, the patient being recumbent and directed to change his position from time to time. No mucus may appear until the stomach has been relieved of whatever food it may contain but, after this has been washed out, further lavage will usually detach mucus from the wall of the organ in considerable quantity. Certain substances calculated to dissolve the mucus may be added to the wash water; among these may be mentioned sodium bicarbonate (1 to 250), lime water (1 to 500), and sodium chloride (1 to 200). Alkaline mineral waters may also be employed. If the stomach contains decomposing and fermenting food a final washing with a disinfectant solution is indicated. Of these there are a number, such as 0.1 percent. salicylic acid, 1 percent. boric acid, 0.6 percent. butyric acid, 1 percent. resorcinol, 0.6 percent. hydrochloric acid, 1 percent. chloroform water. This last is prepared by adding the chloroform, shaking the mixture, allowing the chloroform to settle and using the water poured off.

In the atrophic form of chronic gastritis, with little mucus, lavage should be employed to stimulate the stomach-lining directly. Decinormal hydrochloric acid may be used and, if stomach analysis shows enzymes to be still present, a solution of sodium chloride not stronger than 1 percent. is recommended.

Drug treatment plays a less important part in the management of the

affection than do lavage and diet regulation. Of the drugs likely to prove beneficial silver nitrate may be mentioned. It may be given by mouth—1.0 grain (0.065), to peppermint water 1 ounce (30.0); dose ½ ounce (15.0) three times a day when the stomach is empty—by means of the intra-gastric spray of a 1-1000 solution, or the organ may be washed with a 1-2000 solution. Bismuth salts, especially the subgallate and the subnitrate given together, often produce a good effect. A powder of 1 part of the subgallate to 3 parts of the subnitrate may be prescribed, of which the dose is 30 (2.0) grains 3 or 4 times a day, or this powder may be applied directly to the lining of the stomach by means of an intra-gastric insufflator. The disadvantage of the bismuth treatment is its likelihood to produce constipation, consequently in connection with it laxative mineral waters and diet should be advised.

In the management of symptoms drugs are often necessary. Of the symptoms which are likely to need attention pain is one. Diet and stomach washing may be sufficient treatment, but if the pain is very distressing the patient may be put to bed and hot compresses snould be applied over the stomach. Opium should be used only as a last resort and may be administered hypodermatically or *per rectum*.

Vomiting is seldom distressing where lavage is employed. When necessary, this symptom may be controlled by sucking bits of cracked ice, by iced champagne taken in small quantities, and by intra-gastric sprays of weak cocaine or menthol solutions.

Eructation may be controlled by lavage or by capsules of magnesia ponderosa or sodium bicarbonate with or without the admixture of a little sodium salicylate. Animal charcoal in doses of from ten to twenty grains (0.66 to 1.33) is also useful.

Constipation is a frequent accompaniment of chronic gastritis. It should not be treated by laxatives but by dietetic means, mineral waters, abdominal massage and by irrigations, if necessary.

Loss of appetite may prove an annoying symptom. It may be managed by various means. Stomach washing with sodium chloride or hydrochloric acid solutions and the administration of the vegetable bitters, especially condurango, nux vomica and gentian, or of basic orexin are recommended. This last is best given in broths in doses of about 3 grains (0.20) before meals.

Artificial digestants are of very limited value. The administration of pepsin either alone or with hydrochloric acid does not increase the digestive power but when there is lack of the stomach ferments and of hydrochloric acid, the latter should be supplied. The dilute acid should be administered in doses of about 20 drops (1.33) after meals, well diluted and taken through a glass tube; if not well borne the dose should be diminished or sodium bicarbonate and pancreatin in doses of 5 grains (0.33) each should be substituted. These are especially useful in old chronic instances. By means of the pancreatin

and the alkali, which must be given in sufficient quantity to neutralize the acidity of the stomach, if any remains, pancreatic digestion is performed in the stomach. Other artificial digestants, of which there are a number on the market, are of little use.

Mineral Waters. The great benefit that sometimes accrues from courses of spa treatment is probably due rather to the rigid regulation of diet and mode of life than to any special therapeutic effect of the mineral waters drunk. It may be stated, however, that in chronic gastritis the salt and alkaline waters, as well as the alkaline-saline and alkaline-hydrochloric waters are useful. When drunk in large quantities they tend to cleanse the stomach of its excess of mucus but in this connection they cannot, in more than a very slight manner, take the place of lavage. It would seem that the alkaline, alkaline-hydrochloric and sodium sulphate waters are likely to benefit gastritis with increased or only slightly diminished hydrochloric acid while the alkaline and saline waters are useful in diminished gastric secretion. In decreased stomach motility with dilatation only small quantities at a time should be allowed.

General Hygiene. For patients who have become weak and emaciated a rest cure should be prescribed. For those of moderate bodily vigor a morning cold tub or sponge, if there is good reaction afterward, is advisable. Cleansing baths of warm water may be taken twice a week. Exercise in moderation should be systematically taken. Five minutes' work with light wooden dumb-bells or clubs before breakfast, at noon, and at bed time, together with walking, golf, horseback or bicycle riding or a moderate amount of swimming or rowing, is an excellent means of keeping the muscular system in condition. Exercises of the muscles of the abdomen, such as those described in works upon physical culture are important in all gastric abnormalities except those attended by hæmorrhage.

Electricity, while it probably has little or no effect upon the secretion or motility of the stomach, is an excellent adjuvant to other treatment of chronic gastritis. Both the galvanic and faradic currents may be employed. Faradism acts in the same fashion as massage and should be administered by applying one electrode to the spinal region while with the other the limbs, and particularly the abdomen, are stroked. Intra-gastric electricity with Einhorn's electrode, by means of which both the faradic and galvanic currents may be applied, is useful and makes an excellent impression upon the patient.

Massage has a particularly good effect in gastritis with dilatation and atony and in patients too weak to take proper exercise. Both general massage and local massage over the abdomen are indicated. The latter plays an important part in sustaining the tonus of the abdominal muscles, and, when given directly after a meal, aids the atonic organ in passing its contents into the intestine.

Diet is perhaps the most important factor in the treatment of chronic gastritis. No fixed list of proper articles of food can be given but each patient must be studied by himself both from a standpoint of his symptoms and with a view to the chemical findings upon stomach-contents analysis. In prescribing a diet the patient himself can materially assist by informing the physician as to what articles of food agree and what do not. At the beginning of treatment the diet should be light and easily digestible and, if the gastric musculature is functionating properly, fluids and semi-fluids should make up the dietary to a great extent. Oftentimes a patient will do better on a number of small meals daily than on three large ones. If the analysis shows hydrochloric acid and pepsin to be present in considerable quantity we may give a diet containing considerable proteid, but, even when there is lack of secretion of these elements, proteid need not be wholly eliminated. Carbohydrates in which there is no admixture of large amounts of cellulose and those which are not likely to ferment are allowable and fat, even in considerable quantity, is not harmful.

The preparation of the food is important. Meats and fish should be cooked in a steam boiler and if necessary may be minced before being served; in all cases they should be finely divided before they reach the patient's mouth.

Milk is an excellent food but often patients bear it ill. In such instances it may be mixed with other articles of diet as purée soups, cereals, etc. When given thus it is usually well digested; often the addition to it of vichy or lime water will render it less liable to undergo fermentation. Soups and meat jellies are usually well borne as are the white meats, sweetbreads, scraped beef and fish. It should be remembered that only small quantities of meat should be given at a time. Cereals are excellent and the lighter vegetables, potatoes, beans, peas, asparagus, etc., may be given in the form of purée soups, which when properly made are very appetizing. Mashed potatoes are allowable and toast or zwieback is preferable to plain bread. Stewed ripe fruits and puddings of rice, tapioca, sago, etc., may be given. It need hardly be stated that highly seasoned foods are out of place although a little mustard or pepper may be given at intervals to increase the appetite.

Such alcoholic drinks as beer, because of the yeast which it contains, and spirits should be avoided and it is better in most instances to forbid the use of fermented beverages entirely, but if they are allowed, a pure wine containing no tannic acid is best. Certain instances of gastritis due to over-indulgence in alcohol seem to digest better if wine is allowed; a good port, tokai or malaga is to be preferred. If lactic acid fermentation occurs upon the use of these sweet wines a good dry champagne may be substituted. Naturally the quantities taken should be small.

Coffee in moderate amount may be taken, but tea, on account of its constipating effect, and tobacco should be stopped.

PHLEGMONOUS GASTRITIS.

Synonyms. Suppurative Gastritis; Purulent Gastritis.

Definition. A rare form of gastric inflammation characterized by a diffuse infiltration of the submucosa, with pus, which may extend to the muscular and peritonæal coats of the organ. Occasionally the pus is localized in an abscess cavity.

Ætiology. This condition may occur idiopathically. Primary phlegmonous gastritis, however, is very rare, most instances being secondary to infectious processes, pyæmia, puerperal sepsis and typhoid fever, for example. The suppurative process may also result from infection of an ulcer or new growth or from traumatism.

Pathology. In the diffuse form the submucosa of the pyloric region is most likely to be the seat of the process. This portion of the wall of the stomach is infiltrated with pus and may necrose; the other coats are thickened. Perforations may take place through the mucosa and the pus may exude into the cavity of the organ. If there is abscess formation,single or multiple collections of pus will be observed.

Symptoms. In secondary phlegmonous gastritis the symptoms closely resemble those of peritonitis with sepsis; there are usually abdominal pain, more or less distinctly localized epigastric tenderness, meteorism, vomiting—the vomitus rarely contains pus, however—diarrhœa, a septic temperature, small, rapid pulse and great prostration. In patients with abscess formation a tumor may be palpable. If the disappearance of such a manifestation is coincident with the vomiting of pus, there is good ground for making a diagnosis of suppurative inflammation of the stomach. Simple vomiting of pus, however, may occur in other conditions, such as an œsophageal or other abscess which may have ruptured into the stomach. Rupture may take place through the wall of the stomach into the peritonæal cavity with the accompanying symptoms of perforation. The disease is quickly fatal, almost without exception.

Treatment. If the diagnosis is made in time, surgical treatment offers some hope and is always indicated; otherwise the treatment is purely symptomatic. Medication given by mouth is ineffectual. The pain may be lessened by sucking cracked ice, applications of cold to the epigastrium and by hypodermatic injections of morphine. Stimulants given hypodermatically and *per rectum* are indicated.

TRAUMATIC AND TOXIC GASTRITIS.

Definition. An inflammation of the stomach caused by swallowing caustic substances, such as acids, alkalies, arsenic, mercury bichloride, etc.

Pathology. The *post mortem* appearances differ with the degree of the

corrosion of the gastric lining. Marked instances reveal a dark eschar covered with necrotic mucous membrane bordered by an inflamed margin. In less severe instances the cells of the gastric mucous membrane are swollen, degenerated and eroded. There may be hæmorrhages and ulcer formation. The fundus exhibits the most marked degree of irritation for this region is reached first by ingested substances. In instances which recover the healed cicatrices may contract and produce deformities of the organ.

Symptoms. These vary in severity with the degree of the irritation, but as a rule there is marked gastric pain, localized tenderness, vomiting and thirst. The vomitus often contains blood, mucus and pieces of exfoliated mucous membrane. Marked instances are characterized by an expression of anxiety, weak, rapid pulse and symptoms of collapse which may terminate in death within a few hours.

The diagnosis is made from the history, but, when this is wanting, eschars about the lips and in the mouth, together with the odor of the breath may suggest the causative factor.

Treatment consists in the administration of antidotes both chemical and physiological; the chemical antidotes in the case of acids being alkalies, sodium bicarbonate for instance, and for alkalies mild acids such as dilute vinegar. The irritation may be soothed by demulcents—milk, albumin water, mucilages, etc.—and free dilution of the toxic substance by drinking water is always indicated. The collapse necessitates free hypodermatic stimulation by means of strychnine, alcohol, etc., and high rectal injections of hot black coffee. The after treatment consists of rest for the stomach, rectal alimentation and the bismuth salts in large doses.

DIPHTHERITIC GASTRITIS.

This is a rare inflammation and may occur as a complication of true diphtheria of the upper air passages or an extension of throat or laryngeal Klebs-Löffler infection to the gastric mucous membrane. Gastritis with the production of a false membrane may also occur as a complication of the various infectious diseases, smallpox, typhoid and typhus fevers, septicæmia, scarlatina and pneumonia. The lesion cannot be diagnosticated *intra vitam*, and is therapeutically of no interest.

MYCOTIC GASTRITIS.

Instances have been reported of gastric infection with certain fungi, notably those of thrush and anthrax. These have followed infections of the mouth; yeast fungi also have been known to set up gastric inflammation. Fortunately the acidity of the gastric secretion is usually able to destroy the swallowed

micro-organisms and in instances in which lesions of this variety have occurred the gastric functions have been at low ebb. The larvæ of the common house fly and other insects have been known to produce inflammations of the stomach.

GASTRIC ULCER.

Synonyms. Ulcer of the Stomach; Peptic Ulcer; Round Ulcer; Embolic Ulcer; Thrombotic Ulcer; Perforating Ulcer; Ulcus Ventriculi.

Definition. A loss of continuity of the substance of the mucous lining of the stomach, not tending to heal but rather to increase both in area and depth. The acute form is likely to spread by increasing its depth while the chronic variety tends to spread laterally; its walls usually slope inward toward the base of the lesion while those of the acute type are more vertical and clearer cut. Perforation into a blood-vessel or through the muscular and peritonæal coats of the organ may occur in either type. The condition is usually characterized by gastric pain, digestive disorders, and at times hæmatemesis.

Ætiology. Gastric ulcer has been attributed to a number of causes. The disease seems to be rare in the United States, but it is probable that many instances are undiagnosticated. It is most common in young adult females. According to Hemmeter there are five chief factors in the production of this lesion. *a.* An interference with the vitality or resisting power of the mucous membrane. *b.* Increased acidity of the gastric juice. *c.* An altered condition of the blood. *d.* Local bacterial infection. *e.* Local traumatism.

The vitality of the wall of the stomach may be impaired by local or general diseased conditions or by interference with the blood supply of a particular area. Thrombosis, usually the result of disease of the blood-vessels, and embolism, infective or non-infective, are the common causes of this interference.

Constitutional diseases, such as the blood dyscrasiæ, syphilis, tuberculosis, arterial diseases of various character, malaria, etc., are to be considered.

Of bacterial infections the most common are those of tuberculosis, typhoid fever and various types of dysentery. Other bacteria have been found in instances of gastric ulcer and may exert a causative influence upon the condition. It must be remembered that while HCl is germicidal it does not destroy bacterial spores and there are times when the glands which secrete this acid are at rest and consequently the antiseptic action of the HCl is slight or absent. Hemmeter suggests that the bacteria cause a primary necrosis and encourage ulcer formation through autodigestion.

Direct injury and consequent impairment of the power of resistance of the mucosa may be the result of the traumatism from the swallowing of various foreign bodies such as fish bones, oyster or nut shells and the like. Corrosive

poisons and the ingestion of very hot liquids or food are factors worthy of consideration and certain observers have exploited the theory that the frequency of ulcer in those in whose work pressure upon the stomach is exerted may be due to an anæmia of the organ resulting from such pressure.

Pathology. Ulcer of the stomach exists by a large percentage most often upon the posterior wall or lesser curvature of the organ and it is rare that a single lesion is found, the condition being usually multiple. The typical round punched-out appearance is not so often seen as is the oval non-symmetrical ulcer with irregular edges. The edges usually slope inward since the mucous coat of the organ is first involved. If there is no tendency toward healing the lesion progresses through the muscular coat and finally perforates the peritonæum covering the viscus. The typical ulcerous perforation is circular and has as cleanly cut edges as if punched out with a die, but as above stated this form is less often seen than the less symmetrical type. During the progress of the lesion the blood-vessels in the stomach wall may be eroded, resulting in hæmorrhage more or less profuse in type. A healed ulcer leaves behind a distinct and typical scar. Accompanying the ulcer there is, as a rule, a complicating gastritis.

Symptoms. The most characteristic symptoms of gastric ulcer are: *a. Localized pain.* This is due to irritation of the sensory nerves laid bare. It is burning in character, most marked after the ingestion of food and frequently increases during the process of digestion. There is local tenderness which is increased on pressure, or by the wearing of a corset. Various other pains due to sympathetic neuralgias of the intercostal nerves, of the left brachial plexus and even of the nerves of the lower limbs may be present. A point of tenderness, "the dorsal point," sometimes exists at the back to the left of the spinal column at the level of the 10th to the 12th dorsal vertebra.

In many instances there is an unpleasant burning sensation in the region of the stomach which is due to irritation of the organ from its hyperacid contents. This "heart burn" may also be referred to the region of the œsophagus.

b. Vomiting. This is the result of excessive peristalsis and reverse peristalsis caused by the irritation and increased acidity due to the ulcer. The vomiting exercises an influence favorable, rather than otherwise, over the course of the disease since the emptying of the stomach allows it to collapse, thus bringing the edges of the ulcer into approximation. The vomiting is usually followed by a temporary relief from pain.

c. Vomiting of blood is a very characteristic symptom of gastric ulcer and is the result of erosion of a blood-vessel. If the hæmorrhage is large a considerable quantity of dark pure blood may be vomited, if small, the blood may remain in the organ, undergo partial digestion and be later vomited as "coffee-ground" matter. The blood resulting from gastric hæmorrhage is

frequently not vomited *in toto* but part may pass through the intestine and appear in the stools as a black, tarry matter. Muscular exertion of any character may induce hæmorrhage.

Excessive hydrochloric acid is present in a large majority of instances of gastric ulcer and by most authorities is considered as a causative factor, rather than a result of the lesion.

The appetite is usually normal or increased, the tongue is not coated and there is likely to be excessive thirst.

Constipation is the rule but a normal condition of the bowels may exist, although the quantity of fæcal matter is likely to be small owing to the lessened quantity of food ingested. The urine is hyperacid except after emesis when it may be alkaline because of the large amount of acid suddenly withdrawn from the body. The chlorides are diminished.

The blood, except after hæmorrhage, when the number of red cells may be much diminished, usually shows a slight decrease in the number of the erythrocytes and a considerable diminution of the hæmoglobin. After hæmatemesis there may also be what is called a "post hæmorrhagic leucocytosis." This usually disappears within a few days.

A distinctly palpable tumor is rarely felt except in old lesions with thickened cicatrices or adhesions to neighboring parts. If a tumor is felt, as a rule it is small, smooth of surface and not movable.

The ulcer may proceed toward healing leaving a cicatrix behind when the process is completed. This latter may contract producing the hour-glass stomach, or a stenosis of the pylorus with consequent dilatation and ptosis, in accordance with the original situation of the lesion, or it may undergo carcinomatous degeneration.

In other patients the ulcer may eat its way through the entire stomach wall and bring about a local peritonitis if adhesions sufficient to shut off the site of the perforation have formed, or, failing this, a general peritonitis. Perforation upward through the diaphragm resulting in pyopneumothorax is a less frequent complication.

The disease is variable as regards its course but under proper treatment 95 percent. of instances should terminate in recovery in from 12 to 14 days. Complete cure, however, should hardly be claimed until the patient has been without gastric pain for a number of months. Frequently the excess of hydrochloric acid remains after recovery has taken place.

The diagnosis of gastric ulcer by means of the test-meal and stomach tube is hardly necessary, and the passage of this instrument, except by a skillful hand, is hardly to be advised. The only striking abnormality found upon chemical examination of the stomach contents in ulcer is an abnormal amount of hydrochloric acid. Digestion does not seem to be delayed in ulcer, but is, on the contrary often accelerated.

Howard in a series of 54 instances of ulcer of the stomach and duodenum reports the following findings. *Total amount of residue:* 54 percent., above normal, 17 percent., below normal, 29 percent., within normal limits. *Total Acidity:* Hyperacidity in 27.5 percent., hypoacidity in 42.5 percent., within normal limits, 30 percent. *Free hydrochloric acid.* Hyperchlorhydria in only 17.6 percent. Normal content of hydrochloric acid in 26.4 percent. Hypochlorhydria in 26.4 percent.

Tests for lactic acid were employed in 43 patients with positive result in 14 percent., doubtful in 7 percent. and negative in 79 percent.

The statement so positively made by most authorities with regard to excessive free hydrochloric acid in ulcer is hardly borne out by the above figures.

Treatment. *Prophylaxis:* patients with increased acidity and subject to discomfort and pain referred to the stomach, without definite signs of ulcer should be put upon a simple and non-irritating diet, and extremely hot or cold food or drink forbidden. The hyperacidity should receive drug treatment.

In the treatment proper of gastric ulcer the problems confronting us are:

1. To encourage healing on the part of the ulcer by *a*, enforcing as complete rest as possible; *b*, protecting it from irritation by food and from other mechanical injury, and from irritation from chemical sources; *c*, by counteracting the secretory fermentive abnormalities taking place within the organ.

2. To treat the distressing symptoms of the condition as they may arise.

3. To maintain the bodily strength by the administration of nourishment *per rectum.*

A period of complete rest in bed on the part of the patient, to last until the gastric pain and tenderness have disappeared, should be enjoined. Unless hæmatemesis has recently occurred or is anticipated, he may read, write and receive visitors in moderation and a daily sponge bath, with or without alcohol should be given.

Gentle massage of the limbs will add to the patient's comfort and augment his recuperative power.

In order to protect the ulcer from irritation and to encourage it toward healing the heaviest of the bismuth salts—the subnitrate—is administered in dosage of 90 to 120 grains (6.0 to 8.0), if given by the mouth, daily. The salt possessing the highest molecular weight is preferable since it will be most likely to sink to the dependent portions of the stomach and consequently come in contact with the ulcerating surface wherever situated. Fleiner, who has been the special advocate of the use of bismuth, is accustomed to administer the drug as follows: Before food is taken in the morning the stomach is washed until the washings return clear and non-acid in reaction; then through the tube 2½ to 5 ounces (75.0 to 150.0) of bismuth subnitrate, free from arsenic, suspended in 6 to 8 ounces (240.0 to 300.0) of water are given. After the withdrawal of the tube the patient should assume the recumbent position

and remain quiet, so that the mixture may come into contact with the ulcer if possible. If the patient is receiving food by mouth he may take his breakfast within a half hour. The bismuth acts not only as a non-irritant protective to the ulcerating surface but favors the healing of the lesion by an antiseptic and astringent action. It is said, also, to decrease the excessive acidity. Being given by the mouth the bismuth is quite as effective as through the tube and passing this instrument may be omitted without influencing the efficacy of the treatment. The insufflation of the drug in powdered form has been practised but presents no advantage over the ordinary method of administration.

In the employment of the bismuth treatment Hemmeter uses one drachm of the subgallate (4.0) to three (12.0) of the subnitrate in a pint (½ litre) of water. He previously washes out the stomach with a solution of sodium bicarbonate ½ ounce (15.0) to the pint (½ litre).

The problem of neutralizing the excessive acidity present in the stomach is often not met successfully because the attempt is not made according to chemical principles. Sodium bicarbonate, a drug frequently employed, is worse than useless since its presence in the stomach results in an excess of sodium chloride and carbon dioxide. The former will split up and give rise to still more hydrochloric acid, while the latter stimulates peristalsis, both of which results are exactly at variance with our purpose. The most effectual method of combating the hyperacidity is by the administration of magnesia ponderosa in dosage of 10 grains (0.66) every four hours. In addition to the reduction of the existing hyperacidity and the prevention of the formation of additional hydrochloric acid from the chemical combination resulting, magnesium chloride is formed which exercises a favorable influence upon the usually co-existent constipation.

Numerous other treatments of gastric ulcer have been from time to time exploited and among them may be mentioned Cohnheim's olive oil treatment which consists in administering this substance in doses of from 1 to 4 ounces (30.0–120.0) three times a day, passed into the fasting stomach, which has previously been washed; as in the case of the bismuth treatment the oil may be swallowed without the use of the tube. It would seem, however, that a previous lavage would increase the efficacy of this treatment, since its object is to allow the oil to come into direct contact with the ulcer and form a protective coat for it. It is claimed also that the oil relieves the nausea and pain, diminishes the excessive acidity and lastly is a food itself. The originator of this method asserts that the milder instances may be fed by mouth during the treatment—the diet, of course, being properly restricted—and strict rest in bed is not necessary.

The systematic rest and mineral-water treatment advocated by Fox and, with certain unimportant modifications, by von Leube and von Ziemssen is

not adapted to the acute instances with hæmatemesis but, after the intervention of two weeks succeeding such an occurrence, it may be pursued. The details of the treatment are as follows: The patient is kept in bed, not even being allowed up to evacuate the bowels and bladder, and is given every morning a glass of Saratoga Carlsbad or Hathorn water (either of which has quite as beneficial effect as the imported Mühlbrunnen of the original treatment) to which 75 to 150 grains (5.0 to 10.0) of Carlsbad sprudel salts (natural or artificial) have been added. The mineral water exerts no specific action, but serves only to keep the bowels open and to lessen the gastric acidity. Local applications to the epigastrium of a flannel compress dipped in hot water and covered with oil-silk are prescribed and renewed every three hours night and day. The diet for the first two weeks of the treatment is limited to milk and beaten eggs. During the third week the patient is allowed to move from his bed to a lounge, but is still kept very quiet, the mineral water is continued, and toast or zwieback, oysters, broiled fish, sweetbreads, calf's brain, or minces of very finely chopped meat may be allowed in small amount. During the fourth week vegetable purées of peas, beans, potatoes or other vegetables, and stewed fruits are permitted. From now on the patient may gradually return to ordinary diet but for years all raw fruits, acid, highly seasoned, cold and hot food and drinks must be interdicted.

In connection with this treatment Hemmeter employs the following prescription to assist in reducing the excessive acidity and prevent auto-digestion. ℞ magnesiæ ponderosæ, sodii bicarbonatis, potassii carbonatis, aa, grains lxxv (5.0); sacchari lactis, drachms viss (26.0). Of this half a teaspoonful (2.0) is taken dry on the tongue every 3 hours.

Silver nitrate has been recommended by Gerhardt. According to his reports the distressing symptoms will often cease directly upon its administration, while in other instances it has no influence whatever and in still others it seems to aggravate the symptoms. He believes that this drug is useful in patients who suffer pain when the stomach is empty, on account of its neutralizing effect upon the hydrochloric acid. His method is to give this agent in doses of from $\frac{1}{10}$ to $\frac{1}{2}$ a grain (0.006 to 0.03) in solution several times in the 24 hours upon an empty stomach.

Boas considers silver nitrate useful especially in the less severe instances of ulcer and in those for whom it is impossible to institute a rest cure. He starts the treatment with $\frac{1}{2}$ an ounce (15.0) of a 1 grain (0.065) to 1 ounce (30.0) solution of the nitrate in peppermint water three times a day on an empty stomach. Later he increases the strength of the solution to 1.2 grains (0.07) to the ounce (30.0) and still later to 1.6 grains (0.1) to the ounce (30.0). In connection with this treatment the diet must be carefully regulated and the patient should remain as quiet as possible.

Numerous other drugs have their advocates in the treatment of ulcer,

among which may be mentioned chloroform. Stepp considers that this agent given in connection with bismuth—chloroform, 1 part; bismuth subnitrate, 3 parts, distilled water, 150 parts—exerts a favorable influence.

Condurango bark, in the opinion of Gerhardt, acts well especially in old ulcers in poorly nourished patients.

Fuchs believes that the action of bismuth in ulcer is not alone due to its neutralizing effect upon the hydrochloric acid and to the fact that it is mechanically a protective but that the subnitrate is reduced to an oxyhydrate which, being dissolved, is absorbed by the granulating tissue and here acts specifically. It also increases the secretion of mucus which has a considerable protective action. Bismuthose, a combination of bismuth and albumin is more astringent than bismuth, more insoluble, and has a greater acid-combining power. Elsner reports good results from its use. Its great disadvantage, however, is the influence of its astringency upon the co-existent constipation. It is particularly useful in combating hyperacidity.

The treatment of the excessive acidity often present in ulcer has received much attention and various methods have been recommended as applicable to the reduction of this manifestation. Ewald uses the alkalies mixed with powdered rhubarb and sugar. Others advocate the use of sodium bicarbonate, which according to chemical principles directly defeats the object with which it is given. Riegel, in uncomplicated instances, advises the following formula: ℞ sodium bicarb., magnesiæ ponderosæ, aa, drachms ii (8.0); saccharum lactis, drachms iii (12.0). To this a small amount of powdered rhubarb may be added if the constipation is marked. Of this ½ teaspoonful (2.0) after meals is prescribed. To patients in whom the increased acidity is continuous the alkali should be given more frequently and in smaller doses.

Atropine has a decided influence in diminishing the secretion of the gastric juice and consequently it and belladonna have their places in the treatment of hyperchlorhydria.

The treatment of the pain is to a certain extent that of the hyperchlorhydria since the former is the result of the latter. Usually the administration of analgesics is unnecessary, for as a rule the pain disappears within a day or two after the institution of the ordinary treatment. In severe instances at the beginning the hypodermatic use of morphine is indicated; however, according to recent investigators, this is likely to cause an increase in the secretion of gastric juice and consequently is to be avoided if possible. Codeine or its phosphate are sanctioned by certain high authorities. Cannabis indica, while acting as a hypnotic to a very slight degree, is likely to cause disagreeable mental phenomena. Strontium bromide is recommended. Orthoform (a methyl æther of benzoic acid) is said to have a marked effect upon the pain of ulcer and Murdoch believes that gastric pain which is relieved by this drug augurs the existence of ulcer.

Local applications such as poultices of flax-seed may afford relief but the Priesnitz *umschlag*—flannel wrung out in hot water and covered with oil-silk—will usually be found to act as well. Sharply localized pain due to peritonitis may be relieved by the ice bag or coil.

Vomiting seldom needs special treatment since it usually ceases upon the institution of the ordinary course of treatment directed toward the cure of the ulcer. If this symptom continues to distress the patient cracked ice may be given and various anti-emetics such as cerium oxalate, grains v to x (0.30 to 0.66), chloretone, grains x to xv (0.66 to 1.00), dilute hydrocyanic acid, minims ii to vi (0.13 to 0.4) in water, chloroform, minims i to ii (0.065 to 0.13) in water, etc., may be used.

Hæmatemesis should be treated by absolute rest and the application of an ice coil to the epigastrium. Cracked ice is allowed by some authorities, while others insist that nothing should be given by the mouth. If the hæmorrhage has been considerable a tube should be very carefully introduced. For this a skilled hand is necessary for the tube must be passed only a very short distance beyond the cardia. A pint (500.0) of water at 120° F. (48.9° C.) is now introduced and allowed to remain. Later the clots should be siphoned out so as to allow the organ to contract and a small amount of water containing about ten grains (0.66) of heavy magnesia is put into the stomach and allowed to remain. Lavage of the stomach with ice water has given good results in a few patients, according to Ewald. The hypodermatic use of morphine sulphate in dosage of $\frac{1}{4}$ of a grain (0.016) will quiet the patient, relieve the air hunger and stimulate the heart action. Ergotal, 20 to 30 minims (1.66 to 2.00), hypodermatically, is recommended by Hemmeter as an excellent hæmostatic. Subcutaneous injections of ergotine, 5 to 10 grains (0.33 to 0.66) in equal parts of glycerin and water, may be found effective. Certain authorities mention hydrastis, hamamelis (witchhazel), lead acetate, iron chloride and other hæmostatic drugs in this connection but it is probable that the irritation caused by their entrance into the stomach more than counteracts their power over the hæmorrhage. Adrenalin chloride in doses of from 10 to 30 drops (0.66 to 2.00) of the 1 to 1,000 solution given in a drachm (4.00) of water has seemed to act well in certain instances of gastric hæmorrhage and it will be interesting to observe the results of its administration under the skin.

Excessive gastric hæmorrhage with its accompanying symptoms of heart weakness, pallor, and general collapse calls for immediate and energetic treatment. The usual means employed in hæmorrhage from any source must be instituted at once. Hypodermatic stimulation by means of camphor and æther or camphor and oil, strychnine sulphate, etc., is indicated. The so-called bleeding of the patient into his own tissues which consists in applying snug bandages to the limbs and thus forcing the blood into the trunk, is an excellent resource as is the administration of copious high rectal enemata

of normal (0.9 percent.) solution of sodium chloride, at a temperature of 105°–112° F. (40.4° to 44.5° C.). Intravenous infusion of saline, or, what may be much more rapidly performed, the giving of the solution under the skin of the fleshy parts of the back, chest or thighs may be advised. For this procedure the only necessary apparatus is a fair sized aspirating needle, a few feet of rubber tube and a funnel. The funnel is filled, the solution allowed to flow through the tube and the needle, and the last is plunged into the subcutaneous tissue of the part selected. If the part is massaged as the fluid is flowing in a pint (500.0) or more of the solution may be given.

A necessary precaution in connection with this as with other methods of stimulation is to take care lest the vascular tension be raised to such an extent as to excite further hæmorrhage and thus defeat our object. The tension should be allowed to remain low lest this accident take place.

Feeding in Gastric Ulcer. During the progress of the treatment most approved by the author—i.e., that of bismuth subnitrate combined with heavy magnesia—the patient is fed entirely by rectum. A nutrient enema, preceded by a high rectal irrigation of about a quart (litre) of normal saline solution at about 105° F. (40.5° C.) to cleanse the intestinal mucous membrane and facilitate absorption, is administered every 4 hours. The enema preferred by the author consists of one-half to one ounce (15.0 to 30.0) of starch paste with 2 to 3 ounces (60.0 to 90.0) of beef extract, liquid peptonoids or panopepton.

Rectal feeding should usually be continued for about two weeks.

Other enemata useful in this disease may be chosen from the following formulæ:

1. Milk, 4 ounces (120.0); the yolks of two eggs; salt, 1 drachm (4.0); claret, 1 ounce (30.0); aleuronat flour, one-half ounce (15.0). (Boas.)

2. Two or three eggs beaten with a little water; 1 ounce (30.0) of dextrinized flour boiled with 4 ounces (120.0) of 20 percent. solution of lactose; one wineglass (30.0) of claret, a little salt. The eggs should not be mixed with the other ingredients until the latter have cooled so that their temperature will not coagulate the albumin of the former.

3. Bouillon, 8 ounces (240.0); wine, 2 ounces (60.0); the yolks of two eggs; dry peptone 1 to 5 drachms (4.0 to 20.0). (Jaccoud.)

4. Milk, 8 ounces (240.0); two to three eggs; a little salt. (Riegel.)

5. Milk, 8 ounces (240.0); liquid peptone, 1 ounce (30.0); yolk of one egg; laudanum, 5 drops (0.33); a small quantity of sodium bicarbonate for chemical neutralization if the peptone is acid. (Dujardin-Beaumetz.)

6. Two eggs; whiskey, one-half ounce (15.0); starch paste, one-half ounce (15.0); milk up to 8 ounces (240.0).

Other formulæ may be made up as occasion requires. In quantity nutrient enemata, according to most authorities, should not exceed 3 or 4 ounces

(90.0 to 120.0), and the proper interval for their administration is about every four hours. Four enemata during the 24 hours are sufficient.

When enemata larger in quantity than the above are well borne it may be wise to give as a routine three daily injections of a pint (500.0) of food each. This procedure relieves the patient of too frequent disturbance and allows his sleep to be unbroken. The enema may consist of the whites of two eggs, a teaspoonful (4.0) of salt, 1½ ounces (45.0) of a saturated solution of glucose, and milk up to a pint (500.0). Such a mixture contains carbohyhrates, fat, proteid and salts in approximately proper proportions.

Nutrient enemata, particularly those of considerable size, are better given from a fountain syringe than by means of the piston variety, since the force and tendency of the latter to sudden spurts may cause irritability of the bowel.

Food given *per rectum* will be more readily absorbed and assimilated if peptonized and not only the milk but the other constituents of nutritive enemata should undergo this process. Preparations for the convenient peptonizing of food substances are obtainable at any apothecary's. By certain patients the enemata may not be well borne or may be difficult of retention on account of irritability of the bowel. Such a complication may be obviated by preliminary cleansing of the bowel by a saline enema and, if this procedure fails, by the addition of a small dose of the tincture of opium to each enema.

Nutrient enemata should be thoroughly mixed and administered warm. 100° F. (37.8° C.), under moderate pressure and very slowly through a soft rubber rectal tube passed as high into the bowel as possible. Care should be taken lest the tube turn on itself and its extremity, instead of being in the sigmoid flexure, be just inside the anus. The best position for the patient to assume while receiving the enema is upon the left side. After about 30 minutes he should turn to the right side and a pillow should be placed under his hips. These positions facilitate the flow of the enema through the colon.

At intervals it may be necessary to give a high enema of clear water for the relief of the thirst.

After the cessation of rectal feeding the return to ordinary diet must be very gradual. The first foods allowed by mouth may be equal parts of milk and lime water, beef bouillon, to which such substances as plasmon, nutrose or somatose may be added, and albumin water. These fluids must be given at a neutral temperature—neither hot nor cold. Sugar solution (20 percent.) may also be allowed. Dextrose is the preferable form of sugar, but cane sugar is allowable. Lactose is least desirable. After about ten days a more liberal diet may be instituted consisting—according to von Leube—of boiled sweetbreads, calf's brain, white meat of chicken, various gruels and vegetable purée soups, tapioca with milk, oatmeal and finely scraped raw beef. After a week scraped raw ham, finely chopped rare broiled beef steak, toast or

zwieback, and mashed potatoes are allowable, as also are stewed fresh non-acid fruits. Further extension of the diet should be postponed as long as possible, but when this becomes necessary the patient may eat broiled chicken and veal, rare roast beef, fish, plain meat soups, etc.

All irritating foods, such as vegetables containing an excess of cellulose, breads with hard crusts, fruits with tough skins, together with alcoholic beverages, should be refrained from until all the symptoms have disappeared and have remained absent for a long period of time. Cold and hot, sour or highly-spiced foods and drinks should be avoided for many months after the cure is apparent.

The anæmia so frequently accompanying gastric ulcer should never be neglected. To combat this important factor in the disease iron and arsenic are our chief reliance. It is needless to say that their administration should not be begun until all the symptoms of gastric irritation have disappeared. Ewald is accustomed to give a 2 or 3 percent. solution of iron sesquichloride three times a day in teaspoonful (4.0) doses in an ounce (30.0) of albumin water. This should be taken through a tube. The various forms of organic iron which have lately been put upon the market should be useful in this connection particularly iron vitellin in half ounce (15.0) doses given three times daily after meals.

Arsenic may be given in the form of Fowler's solution or arsenic trioxide. The various mineral waters containing iron and arsenic will be found useful.

The surgical treatment of gastric ulcer may be divided into:

a. The treatment of the ulcer by excision.

b. The treatment of hæmorrhage.

c. The treatment of perforation.

d. The treatment of gastro-peritonæal adhesions.

e. The treatment of the various resulting gastric deformities such as stenosis of the pylorus, hour-glass contraction, etc.

It is conceded by most surgeons that acute gastric ulcer is a medical condition but chronic ulcer with obstinate and persistent emesis and pain may be treated surgically by excision or cauterization. In multiple ulcer excision of all the ulcerating points is, however, impossible. Ulcers situated near the pylorus and associated with pylorospasm may be relieved and even cured by the operation of gastroenterostomy. In ulcers of other regions of the stomach this operation may also afford relief.

Repeated hæmorrhage, unless the patient is too anæmic to withstand the shock of operation, probably constitutes an indication for surgical treatment. If possible the bleeding point should be cauterized or excised. If these are multiple, gastroenterostomy should be performed.

Perforation should be treated surgically as soon as the diagnosis is made, unless it is an absolute certainty that adhesions shutting off the site of the

perforation from the general peritonæal cavity, have been formed. The longer operation is postponed after the contents of the stomach has been emptied into the peritonæal cavity the less the likelihood of the recovery of the patient.

Adhesions about the stomach which cause pain and other unpleasant symptoms may necessitate surgical interference. Hour-glass contraction and other post-ulcerous deformities of the organ are also amenable to operative treatment.

CANCER OF THE STOMACH.

Synonyms. Gastric Cancer; Carcinoma of the Stomach; Carcinoma Ventriculi.

Ætiology. The direct ætiology of cancer is unknown. Heredity plays some part in its causation and gastric ulcer is undoubtedly a predisposing cause. Cancer of the stomach is rarely seen before middle age and is more common in males than in females. It not infrequently occurs in individuals who have had apparently healthy stomachs during their earlier years.

Pathology. Cancer of the stomach is usually primary. All varieties of carcinoma may occur in the stomach but the most frequently seen are:

a. The scirrhus which is an infiltrating growth, hard and dense in structure; it usually involves a considerable portion of the submucosa and may spread through its whole extent.

b. The medullary type develops rapidly, is likely to ulcerate and is prone to extend directly or by metastasis to other structures.

c. The colloid variety grows to a larger size than do the other types and frequently spreads by direct contiguity to neighboring tissues, making with them a mass of considerable size.

The majority of gastric carcinomata begin near the pylorus and from this point tend to extend along the curvatures, involving chiefly the submucous coat. The growth, as a rule, originates in the tubules, it progresses, infiltrating and causing induration of the remaining tissues of the organ, and results in a nodular tumor which may ulcerate. The neighboring lymphatic glands become hardened and enlarged and may themselves become the seat of carcinomatous growth. When the tumor is at the pylorus stenosis results which causes dilatation of the organ, otherwise the stomach tends to diminish in size. Ulcerations infrequently perforate the stomach wall but often erode a blood-vessel and cause hæmorrhage.

Symptoms. Before gastric cancer is suspected the patient is prone to indefinite symptoms referred to the stomach, such as loss of appetite, distress, eructations of gas and constipation, but it must be remembered that the growth may exist for considerable time without giving rise to any symptoms which call attention to the stomach. The cancerous cachexia, with its characteristic

color of the skin, anæmia, and loss of flesh and strength becomes sooner or later apparent and palpation of the stomach may or may not reveal the presence of a tumor which is rarely observed in the normal region of the pylorus. It is more likely to be near the umbilicus but may be found much lower. The reason for this displacement is that the weight of the tumor drags the stomach downward. The tumor varies in size and in consistency and may not be nodular, it may be either fixed or movable; a pyloric growth is not likely to change its position on respiration but the contrary is true of tumors upon the curvatures. At times when situated over the aorta the tumor may seem to pulsate, but this pulsation is *non-expansile.*

It is not very unusual for no tumor to be palpable even in the latest stages of the disease.

As the disease progresses the vomiting usually becomes more distressing. The vomitus consists of food particles and at times contains blood or "coffee-ground" material—the result of the admixture of the gastric secretion and blood; it may be of foul odor and if particles of food are detected which have been eaten a number of hours previously, we may, in the presence of other suggestive symptoms, diagnose a malignant pyloric stenosis. Vomiting is less frequent when the growth is situated in portions of the organ other than the pyloric region. In the later stages there may be lymphatic enlargements in the clavicular and inguinal regions, enlargement of the liver, jaundice, œdema of the lower limbs and an irregular febrile movement. Albumin may be present in the urine, and the presence of metastatic growths, particularly in the liver, may be detected. Blood examination shows a diminution in the red cells, seldom, however, below 2,000,000, and a corresponding decrease in hæmoglobin; the hæmoglobin index is low, a point which is of assistance in the differential diagnosis from pernicious anæmia. The white blood cells are, as a rule, increased to a moderate degree—20,000 or thereabouts—the increase being confined primarily to the polymorphonuclear neutrophiles. In advanced stages of the disease nucleated red cells and myelocytes have been observed.

The Stomach Contents. Chemical examination of the gastric contents withdrawn after a test-meal reveals an almost total or an entire absence of free hydrochloric acid and an excess of lactic acid (Boas's sign). While absence of free hydrochloric acid and an excess of lactic acid may occur in other lesions, if repeated gastric analyses after test-meals show these conditions to be constantly present and the clinical symptoms point toward malignant neoplasm, the probability is strongly in favor of the existence of gastric cancer. The microscope should always be employed in the examination of the result of the test-meal and significant findings are blood, the Boas-Oppler bacillus and fragments of the growth. The Boas-Oppler bacillus is said to be present in gastric cancer almost without exception and if a piece of the tumor can

be demonstrated to be carcinomatous tissue the diagnosis is established beyond doubt.

Röntgen ray examination may reveal the presence of a tumor in certain patients but this means of diagnosis is as yet hardly trustworthy.

The prognosis is distinctly unfavorable, medical treatment offering no hope. Radical surgical intervention, early in the course of the disease, may be attended with good results, but the diagnosis is seldom made before surrounding structures are involved, rendering entire removal of the malignant neoplasm impossible. The disease is usually fatal within a year but under surgical treatment this period may be slightly lengthened.

Treatment. Medical treatment is merely palliative and consists in relieving the pain, improving the digestion and keeping up the patient's nutrition. By attention to these factors life may be prolonged and made more comfortable.

The pain may be controlled by means of hot or cold applications to the epigastrium. When it is apparently due to retained and fermenting food it may be effectually relieved by gastric lavage and removal of the exciting cause. Sodium chloride, in 30 grain (2.0) doses well diluted, thrice daily will often relieve pain. The narcotics should be used with care; belladonna extract, gr. $\frac{1}{6}$ (0.01), may prove effectual and codeine may be employed; hydrated chloral should rarely be used because of its liability to cause heart weakness; morphine may be given hypodermatically when all else fails.

The appetite may be improved by the administration of various stomachics. Of these condurango has been exploited as a specific in gastric cancer. While exerting no effect upon the course of the disease it does increase the appetite and aid digestion. It may be given with hydrochloric acid which also acts as a tonic upon the organ, in the following formula: ℞ fluidextracti condurango, ℥ii (60.0); strychninæ sulphatis, gr. $\frac{1}{3}$ (0.02); acidi hydrochlorici diluti ℥iv (15.0); fluidextracti gentiani q.s. ad ℥iv (120.0); misce et signa, one teaspoonful (4.0) in a wine-glass (60.0) of water through a tube, after meals. Lavage with plain water or with infusions of the vegetable bitters cleanses the stomach and acts favorably upon the appetite.

Vomiting may be controlled by lavage since it is frequently due to the stagnation and decomposition of food in the stomach. When the vomitus is of foul odor washing the organ with various antiseptic solutions such as those suggested under the lavage treatment of chronic gastritis (p. 352) is indicated. Other means of relieving nausea and vomiting are bits of cracked ice in the mouth, sips of iced champagne, carbonic water, tincture of iodine, cold applications to the epigastrium, and hypodermatic injections of morphine. If the vomiting persists the patient should be fed exclusively *per rectum* for a few days.

(For the treatment of hæmatemesis see treatment of gastric ulcer, p. 365.)

Constipation is not infrequent and is better treated dietetically and by means of enemata of water or oil, or suppositories, than by means of purgatives. In persistent instances, we may, however, employ the milder laxatives, such as rhamnus purshiana, rhubarb or aloes, singly or in combination. Their depleting effect should contra-indicate the salines and the purgative waters.

Diarrhœa may be combated by means of phenyl salicylate (salol), bismuth subsalicylate or subgallate, beta naphthol bismuth (orphol) and other intestinal antiseptics. Stomach lavage is often effectual in preventing diarrhœa, since it removes the cause, the fermented and decomposed contents of the dilated stomach.

The anæmia and cachexia necessitate the administration of the preparations of iron and arsenic and the exhibition of heart stimulants, particularly strychnine.

In instances of carcinoma with obstruction at the œsophageal entrance the passage of a bougie from time to time will keep the passage clear but great care must be exercised. Potassium iodide and arsenic are said to delay closure in such patients. When swallowing becomes impossible the patient must be fed through the tube or a gastric fistula must be made.

Diet is the most important factor in the management of gastric cancer and unfortunately no suitable diet list can be laid down as applicable to all. Each patient must be studied by himself. The food allowed should be easily digestible, finely divided and as concentrated as possible. The patient should be consulted as to what foods attract him and what disagree with him and, while carbohydrates, fats and proteids may be allowed when there is no obstruction or fermentation, when these are present the diet should be chiefly of proteid. It is usually best to prescribe small meals at frequent intervals especially if there is motor insufficiency. Milk in small amount at a time may be given if it is well borne; peptonized milk, the fermented milks, koumyss, matzoon and kefir, often are preferred by the patient; all meats and fish should be eaten minced and in small amounts only, at a time. The green vegetables, cereals, purée soups, stewed fruits, toast and zwieback are allowable as are also cocoa, chocolate, especially von Mehring's "Kraft-chocolade," tea and coffee. Alcoholic drinks, such as beer, which are likely to ferment in the stomach should not be taken but the light wines may be permitted. The artificial substitutes for meat may be given but they are merely makeshifts; of these the best are probably nutrose and somatose.

Surgical treatment affords the only hope of complete recovery from gastric cancer and this may be brought about only when operative interference is undertaken in the early stages. The operation consists in complete removal of the tumor and is most likely to prove successful when this is situated at the pylorus.

When the disease has progressed so far that removal of the neoplasm in

its entirety is impossible, a gastroenterostomy permits free egress of the stomach contents into the intestine and prolongs the patient's life. He may even gain flesh for a time following this procedure.

Certain authors believe that in all patients, in which the diagnosis of gastric cancer cannot be ruled out, an exploratory laparotomy is indicated and that even benign pyloric strictures should be excised.

HYPERTROPHIC STENOSIS OF THE PYLORUS.

Definition. A condition characterized by hypertrophy of the muscular coat of the stomach at the pyloric orifice and usually accompanied by spasm and interference with the passage of stomach contents into the duodenum.

Ætiology. The ætiology of the congenital form is unknown; the acquired variety is rarely seen before middle age and our knowledge of the causation of it is limited. It may occur as a result of a congenital abnormality but more frequently appears to be due to a chronic inflammatory condition of the stomach. The disease is a rare one.

Pathology. In the congenital type the muscularis of the entire stomach is the seat of some degree of hyperplasia, but especially is this the case at the pylorus; here the gastric wall is firm to the feel and dense in texture. The chief seat of the hypertrophy is the coat of circular fibres, the longitudinal coat seldom being much involved. The stomach itself may be contracted and the pyloric hypertrophy may extend to some extent throughout the remainder of the muscularis. Dilatation of the organ is unusual.

In the acquired variety of this condition, when the hypertrophied tissue is limited in extent to the pyloric region, there is likely to be dilatation, when there is general thickening of the muscular coat contraction of the organ is more common.

Symptoms. Congenital pyloric stenosis is evidenced by frequent and persistent vomiting without assignable cause. The vomiting may occur directly after the ingestion of food or an hour or more later and the fact that no bile is found in the vomitus is significant. Rarely is a tumor palpable. The patient rapidly becomes emaciated and death may follow within 3 or 4 months.

In adults the principal symptom is gastric pain with a sense of fullness and pressure. If there is co-existent dilatation and muscular atony, emesis may occur. A palpable tumor may or may not be present but the thickened pylorus is usually distinguishable by the skilled observer, especially in thin subjects and fortunately, for the sake of diagnosis, these patients usually are ill-nourished although true cachexia is not a feature of the condition. This fact, together with the rarity of the disease and its freedom from hæmatemesis, is a useful point in the differentiation from malignant disease. The prognosis as to recovery without operation is, in both types of this disease, bad.

Treatment. The palliative treatment of the congenital form consists of

lavage to remove retained food and to prevent vomiting. Feeding through the tube may relieve that form of reflex vomiting which sometimes results from the mere act of deglutition. Surgical intervention in pyloric stenosis offers the only hope of recovery. The operations applicable are gastroenterostomy, pyloroplasty and excision of the pylorus. Loreta's operation (manual dilatation of the pyloric orifice) is not advised.

In adults the treatment aside from surgical interference is that of the causative chronic gastritis (see p. 351 and ff.).

GASTRIC DILATATION.

Synonyms. Dilatation of the Stomach; Gastrectasis.

Definition. A condition of the stomach in which its capacity is increased.

Ætiology. In the causation of gastric dilatation two factors must be taken into account. 1. Atony of the musculature of the organ due to frequent distention by excessive quantities of food or drink, to inflammatory interference with the nourishment of the stomach, as in chronic gastritis, and to various constitutional diseases which lower the tone of the muscular system in general, such as the acute infectious diseases, pulmonary tuberculosis, various nervous diseases, the anæmias, diseases of the heart, liver or kidneys, etc. 2. Dilatation due to pyloric obstruction caused by malignant growths, hypertrophy or thickening of the gastric wall at this situation, contraction of cicatrices following ulcers, traumatism, etc., and pressure from without of adhesions, abdominal tumors or misplaced viscera, or the habitual wearing of over-tight corsets. The disease is one of adult life, though it has been met in children.

Pathology. The capacity of the organ may be increased to three or four times the normal, which is a little over a quart (litre). Its lower border is, in consequence, markedly displaced downward. There is atrophy of all the coats and the wall is often thinned as a result of the stretching which it has undergone, while at times there may be thickening due to the replacement of the normal structure with connective tissue.

Symptoms. These are a sense of weight in the epigastrium, especially after a full meal, eructations of gas often mixed with liquid or food particles, and nausea, which at times is followed by emesis. The vomitus is frequently of large amount and may be seen to contain bits of food which have been ingested a number of days previously. The appetite may be good or poor and there is often thirst. The bowels are usually constipated and the urine is often scanty, highly colored and loaded with urates.

As the disease progresses the patient becomes anæmic, weak and emaciated. A condition known as gastric tetany may develop as a result of absorption of the toxins generated by the decomposition of the stagnant food retained in the stomach. The tetanic convulsions follow premonitory sensations of drowsiness, tingling of the extremities and sometimes vomiting. The move-

ments affect both sides of the body, one, usually, less than the other, involve chiefly the muscles of the limbs and face and are accompanied by pain. Death from exhaustion and preceded by loss of consciousness is a frequent consequence (75 percent. of patients).

Physical Signs. Inspection in thin patients, particularly if the stomach is distended with food or gas, may reveal the greater curvature even several inches below its normal level (1½ to 2 inches above the umbilicus) and in marked instances the line of the lesser curvature may be demonstrable. Peristaltic movements from right to left may be observed to stop at the pyloric region where a prominence due to a tumor may be visible. If the organ is artificially distended by gas, resulting from the administration of ½ drachm (2.0) of tartaric acid in a little water and a couple of drachms (8.0) of sodium bicarbonate, also in water, given separately, or by inflating with a bicycle pump through an ordinary stomach tube, the examination will be greatly facilitated. One must be careful however to rule out the possibility of ulcer before employing these procedures.

Palpation enables us to feel what we have hitherto seen and even when not visible, the border of the stomach may be demonstrated by this means. A palpable tumor may be made out and peristalsis also may be felt. Light pressure quickly made and as quickly released may bring out splashing sounds which may be distinctly audible to the lower limit of the organ. These sounds are more easily obtained and more plainly heard than over the normal stomach.

Percussion plainly evidences the borders of the enlarged organ, the note over it being tympanitic in character when the patient is recumbent; when he is upright it is flat in its lower part owing to the fluid or food in its most dependent portion; distention of the stomach by water and of the colon by air or *vice versa* may aid the observer in mapping out the borders of the organ.

The use of the stiff sound may show the greater curvature to be at a lower level than normal, and its extremity may be palpable through a thin abdominal wall.

The *gastrodiaphane*, an instrument constructed to illuminate the stomach by electric light, may be employed. This, in a word, consists of a small incandescent lamp at the extremity of a stomach tube and when passed into the organ aids in determining its size and position. The examination must take place in a dark room. When the stomach is filled with a fluorescent medium the value of this method of examination is much enhanced. Also bismuth subnitrate in dose of 2 drachms (8.0) may be administered and the patient subjected to a fluoroscopic examination ten minutes later. Skiagraphs, likewise, taken after the ingestion of bismuth may demonstrate the gastric enlargement.

The administration of certain drugs which are not absorbed from the stomach and, which after passing the pylorus, are excreted in the urine is another

means of testing the gastric tonicity and the patency of the pylorus. In this connection phenyl salicylate (salol) may be employed. Normally salicyluric acid should be present in the urine within 5 or 6 hours after its administration. Urine containing this acid takes a port wine color upon the addition of a small quantity of the tincture of iron chloride.

Stomach Contents. The organ should be washed on the evening before the test-meal is given in order to remove its decomposing and stagnant contents. The examination of a test-meal withdrawn an hour after its ingestion gives evidence of delayed and imperfect digestion and if cancer is present there will usually be absence of free hydrochloric acid and presence of lactic acid and the Boas-Oppler bacillus, otherwise the content of free hydrochloric acid is variable. Numerous organisms, yeasts, sarcinæ and other bacteria, are usually present in large numbers and butyric and acetic acids may be found.

Treatment. The medicinal treatment of this condition consists in administering drugs calculated to improve the muscular tone of the stomach and to lessen the tendency to decomposition of the retained food. As a muscle tonic strychnine is most valuable. It may be given alone or in combination with physostigma—strychnine sulphate, gr. $\frac{1}{20}$ (0.003) and extract of physostigma, gr. $\frac{1}{6}$ (0.01) three times a day. If the hydrochloric acid is diminished in quantity the dilute acid should be prescribed; this substance is also useful in neutralizing the gastric fermentation. Hyperacidity may be neutralized by heavy magnesia, gr x (0.66), bismuth subcarbonate and sodium bicarbonate, of each, gr. v (0.33) given about an hour after meals, and fermentation may be retarded by the following formulæ ℞ resorcinolis, gr. lxxv (5.0); bismuthi subsalicylatis, pulveris rhei, sodii sulphatis aa ʒii ss (10.0); sacchari lactis ʒiii ss (14.0); misce et signa, ½ teaspoonful (2.0) twice a day (Ewald). Pancreatin may be used in patients which do not bear hydrochloric acid well, and creosote and guaiacol are recommended—♏ v (0.33) in capsules—as antifermentatives.

Lavage usually will relieve the vomiting and at the same time is an important adjunct to the treatment, since by this means we may remove the decomposing contents of the stomach. The addition to the wash water of antiseptics (see p. 352) is often advisable.

Constipation is frequent, the intestine being often atonic as well as the stomach. Purgatives should never be given but a movement of the bowels should be secured daily by diet regulation. A glass or two of cold water on rising and the ingestion of stewed fruits, green vegetables, graham or whole wheat bread, together with proper abdominal massage and electricity, usually suffice in this regard. Intestinal irrigations may be given from time to time. If laxatives are absolutely necessary rhamnus purshiana is the least objectionable.

Massage and electricity are necessary, the former being employed only when the stagnant contents of the stomach has been removed and the latter, the intra-gastric faradic current especially, is to be given as described on p. 354.

The tonic effect of hydrotherapeutic procedures, especially the cold morning sponge, is not to be overlooked and the fact that properly fitting abdominal binders can do much toward supporting the prolapsed and enlarged organ must not be ignored.

Diet. The patient must be warned not to eat or drink large quantities at a time, but should be advised that four to five small meals per day are preferable to three large ones and that he must avoid all foods likely to cause fermentation—especially fats and sweets. Liquids should be restricted to a quantity not greater than 3 pints (1½ litres) during the 24 hours. If thirst is troublesome further fluids may be given *per rectum.*

The conditions revealed by repeated gastric analysis will demonstrate the diet applicable to each particular case. With plenty of free hydrochloric acid the red meats may be allowed, also cereals, gruels, eggs, and vegetables which last must be mashed or better given in purée form; the carbohydrates aside from those above mentioned must be restricted. When the free hydrochloric acid is abnormally small in amount more carbohydrates may be taken but the animal proteid element of the diet should be restricted to the white meats, fish, calves' thymus, etc.

Alcoholic drinks are best omitted, but when a light sweet or sour wine seems to benefit the patient it may be allowed in small quantity—two sherry glasses at each meal, for instance.

Surgical Treatment. For patients who continue unrelieved despite medical treatment the question of surgical intervention must be considered. Where the dilatation and atony are due to pyloric obstruction pyloroplasty, pylorectomy or gastroenterostomy is applicable, depending upon the conditions which confront us.

A dilatation depending merely upon atony of the gastric musculature may be relieved by a gastroenterostomy or by gastroplication. Both physician and patient, however, must not lose sight of the fact that none of these operative procedures is by any means certain to bring about complete relief and that the adhesions and other factors that are likely to follow a laparotomy may render the patient's discomfort little less than before he entered the surgeon's hands.

ACUTE GASTRIC DILATATION.

Synonym. Acute Gastrectasis.

Definition. An acute, rapid dilatation of the stomach.

Ætiology. Various causes are said to bring about this rare condition; certain instances appear to be idiopathic, others take place as a result of some influence on the nervous system producing a paralysis of the nerves of the organ in question. Acute dilatation may occur during the infectious diseases, pneumonia, meningitis or peritonitis; as a result of acute obstruction of the

pylorus, as from a foreign body; after parturition, abdominal operations, or anæsthesia, where it has been thought to be due to the swallowing of anæsthetic-impregnated mucus from the throat. Constriction of the duodenum by the superior mesenteric vessels has been considered a factor in its causation, and it may follow the rapid consumption of very large amounts of food and drink.

Pathology. After death the wall of the stomach is thin, its cavity is large and its greater curvature may extend far below the umbilicus. The viscus contains gas, fluid which is usually watery and of a greenish tinge, rarely it is thick and brownish, and perhaps undigested food.

There may be drops of blood upon the lining of the organ and the blood-vessels are dilated.

Symptoms. The onset of the condition is usually sudden, although after operations it may not appear for a day or two. There is usually little pain and the thirst is marked. The abdomen is greatly distended and vomiting is present as a rule, the vomitus being thin and tinged with green or brown. The outline of the stomach is often plainly apparent but peristalsis is seldom visible. There is no rigidity of the abdominal wall. The constitutional symptoms are those of great depression, with subnormal temperature, rapid, weak pulse and rapid and shallow respiration. Death may take place in collapse. The prognosis is bad but all instances do not terminate fatally.

Treatment. Prophylaxis consists in washing the stomach if there is marked vomiting after anæsthesia. Since the condition may be the result of the absorption of toxic substances from the stomach this organ should be subjected to frequent lavage, and the intestine should be cleared by means of high irrigations. Rest from the work of digestion is advisable, consequently rectal alimentation should be undertaken, and as relapses may occur even after several days, food and drink by mouth should be given with the utmost caution. As soon as the condition of the stomach will allow, small doses of calomel or of a saline should be given and frequently repeated.

The constitutional depression should be combated by means of hypodermatic stimulation—especially strychnine and atropine—hot applications to the extremities, hypodermatoclysis, etc.

HOUR-GLASS OR BILOCULAR STOMACH.

Definition. A condition in which the stomach is divided by a constriction into two parts, more or less equal in size. It is a rare state and still more rarely is the organ separated into three or more sacs.

Ætiology. The bilocular stomach may be congenital—though this statement is refuted by some authorities—or acquired. The latter form is usually the result of the cicatricial contraction of ulcers or erosions from the ingestion

of corrosive substances, more seldom is it due to outside adhesions or malignant growths. The theory has been advanced that it may follow tight lacing. There is said to be at times a contraction of the gastric musculature at the seat of the constriction.

Pathology. The organ presents a sacculated appearance and at the constriction the muscle fibres may be thickened. This is by no means always the case for the narrowest part of the organ may be devoid of muscular tissue and consist of a fibrous cicatrix.

Symptoms. Moderate degrees of hour-glass stomach often cause no characteristic symptoms. There is usually more or less discomfort referred to the organ, which at times may be increased, due to spasm of the hypertrophied muscle fibres about the constriction. The fact that the gastric muscle must force the ingesta over and through the contraction finally gives rise to an atonic condition which is likely to result in dilatation. Diagnosis without physical examination is impossible and fortunately the condition is accompanied by a number of unmistakable signs. When the stomach seems empty and the tube has been passed with no result palpation may elicit a splashing sound, due to the fact that the pyloric sac of the organ contains fluid while the cardiac sac is truly jejune. At times during lavage the reflux will be found to exceed the influx in quantity. Distention of the organ by air may, in thin subjects, reveal the constriction with a dilatation upon either side. When this sign cannot be seen the borders of the stomach may be palpable and the condition thus made out. The two portions of a Seidlitz powder given separately by their evolution of gas will distend the cardiac sac at once while the pyloric sac may not be distended at all or may be seen to slowly enlarge as the gas enters it through the constriction. The gastrodiaphane may simplify the diagnosis and Hemmeter's rubber bag when inflated in the stomach reveals a distention of the cardiac pouch only. A skilled manipulator may succeed in passing a tube through the constriction and obtaining contents from the pyloric pouch which differs materially on chemical analysis from that previously obtained from the cardiac sac.

Long standing instances of this condition lose flesh and strength, lack proper nutrition and may terminate fatally.

Treatment, aside from relieving the symptoms, is purely surgical and consists in the performance of a plastic operation at the site of the constriction or of a gastroenterostomy to bring about a communication between both sacs and the intestine.

VISCEROPTOSIS.

Synonyms. Glénard's Disease; Splanchnoptosis; Enteroptosis; Gastroptosis.

Definition. A condition characterized by a falling of the abdominal viscera

to a level lower than the normal and due to a relaxed state or stretching of the mesenteries and peritonæal ligaments combined with relaxation of the muscular wall of the abdomen. The ptosis may involve the liver, spleen, stomach, intestines and kidneys.

Ætiology. This condition is more common in women in the proportion of about 3 to 1, this fact probably being due less to the wearing of over-tight corsets than to the extraordinary stretching of the abdominal wall attendant upon pregnancy. The loss of muscular tone and of fat resulting from prolonged inflammations of the alimentary tract, from the wasting diseases, excessive loss of blood, etc., and over-exertion predispose to downward displacements of the abdominal viscera. Glénard's original hypothesis that a dislocation of the hepatic flexure of the colon caused by a stagnation of fæcal matter is the beginning of a general ptosis is probably less correct than the theory that the condition is due to factors such as those mentioned above. Of late the idea has been advanced that there may be a congenital predisposition to visceroptosis since in the fœtus and even in the newly-born child the viscera may occupy an analogous position in the abdominal cavity.

The fact that the displacement may not involve all the abdominal organs must not be overlooked, for it is not unusual to find a kidney, the stomach, the liver or the spleen in abnormal locations.

Symptoms. These are indefinite and indeed the condition may exist without causing any symptoms whatever. In general, however, the patient complains of various dyspeptic symptoms, such as poor appetite, sensations of distention and weight and eructations and rumblings in the digestive tract. Rarely the appetite may be increased; the bowels are usually constipated, though the opposite condition may be present. The breath may be foul, the tongue coated and the mouth dry. Nervous manifestations, such as dizziness, depression of spirits, headache, sleeplessness, palpitation, and tingling and sensations of cold in hands and feet are frequent. Considerable bodily emaciation is not rare. A chlorotic condition of the blood is frequent.

Physical examination reveals an abdomen prominent and baggy in its lower part, relaxed and thin of wall. On palpation the abdomen has a characteristic doughy feeling and splashing sounds may be easily elicited. The edge of the liver, when this organ is displaced, may be felt lower than normal, the kidneys and spleen may be palpated. Percussion of the liver shows its upper limit to be displaced downward. The displacement of the stomach may be demonstrated by any of the means described under gastric dilatation (p. 375 and ff.) and it may be shown to be in a position more vertical than normal, its cardiac end usually being in the normal situation and the pylorus far from its proper site. The tenth rib may be movable (Stiller's sign).

Treatment. Drugs have no great part in the management of this condition

the principal object being to replace the abnormally situated viscera and to maintain them in their normal position. This may best be done by putting the patient in bed, keeping him there and fattening him. He should be overfed and as adjuvants to this treatment faradic electricity and the high frequency current may be employed. Physostigmine salicylate in doses of gr. $\frac{1}{100}$ (0.0006) three times a day is useful to restore the tonus of the intestinal musculature. This may be given alone or in combination with strychnine sulphate gr. $\frac{1}{20}$ to $\frac{1}{30}$ (0.003–0.0025) and capsicum, gr. i (0.065).

The bowels should be kept open by means of vegetable laxatives such as aloes or rhamnus purshiana if necessary, but the diet should be depended upon to regulate this function in so far as possible, fruits and foods leaving an undigested residue being particularly indicated. When diarrhœa is present it may be controlled by intestinal antiseptics such as bismuth subsalicylate, resorcinol or benzo-naphthol, and when gastric analysis shows hydrochloric acid to be diminished in quantity this substance may be supplied.

When the cure by means of rest in bed is inconvenient or impossible the patient may receive much relief from wearing a properly fitting abdominal binder such as can be furnished by any reliable truss maker. The patient should be taught by his physician how to replace the viscera and this should be done in bed each morning and the belt applied before the erect position is assumed.

As a substitute for the abdominal band strapping with zinc oxide adhesive plaster (preferably spread on moleskin) strips has been suggested and often achieves excellent results (Rose).

It should hardly be necessary to state that tight lacing is contra-indicated in ptosis of the viscera and that women should be advised to wear skirts suspended from the shoulders rather than from the hips.

Physical methods such as massage, either by the physician or the patient himself, moderate exercise, such as bicycling, golf, etc., and hydriatic procedures have a place in the management of this condition after the rest cure has succeeded in restoring the organs to their normal situations.

The dietetic treatment of visceroptosis offers difficulties. The problem in hand is to fatten an individual whose powers of digestion and assimilation are impaired and to over-feed such a patient without disturbing his already poor digestive ability is not an easy task. And again the difficulty is enhanced by the fact that the regimen for each patient must be chosen with reference to his particular capabilities. During the early part of the rest cure a milk diet should be instituted if the patient can digest and is satisfied with it, later more latitude may be allowed and, if the digestive powers permit, a general diet should be prescribed.

If the patient is not undergoing the rest cure and is up and about he should not eat large quantities at a time lest the stomach become over-loaded and the

ptosis accentuated; here four or five small meals per day of concentrated food stuffs are preferable to three of large or ordinary size. Fats may be eaten if they can be digested. Gastric analysis and observation of the patient in hand will indicate far better the proper diet than can any list of food articles arbitrarily set down.

Surgical measures, such as taking reefs in the lengthened mesenteries, suturing the lesser curvature of the stomach or its anterior wall to the anterior parietes of the abdomen and suturing the edges of the recti abdominis muscles together after having removed the intervening tissues, have been employed with varying results.

NEUROSES OF THE STOMACH.

HYPERCHLORHYDRIA.

Synonyms. Gastric Hyperacidity; Gastrosuccorrhœa; Gastroxynsis; Nervous Hypersecretion of Hydrochloric Acid.

Definition. Excessive secretion of hydrochloric acid by the gastric tubules occurs in various gastric disorders but there is a class of patients in which there is a hypersecretion of gastric juice which takes place in the absence of food or of any inflammatory condition. It is usually considered a neurosis and exists in two chief forms.

a. Paroxysmal hyperchlorhydria.

b. Continuous hyperchlorhydria. This is a chronic state and was first described by Reichmann whose name has since that time been associated with the condition.

Ætiology. Hyperchlorhydria has no distinct causative factor. It is most frequently observed in persons of neurotic temperament. It is more common in the young and middle-aged and is often seen in chlorotic subjects; it is predisposed to by various mental influences such as grief, worry, etc. Some subjects are afflicted with it directly after eating or drinking certain substances.

Symptoms. These are practically identical in the two forms except that in the paroxysmal variety they appear intermittently while in the continuous type they are always present. The most prominent symptoms are pain referred to the stomach, "heart burn," the eructation of gas, thirst and nausea. Vomiting is infrequent and when present the very acid taste of the vomitus is noticed. Headache is common. The appetite is usually good and the bowels are, as a rule, constipated. The acidity of the urine may be reduced owing to the excess of gastric acidity.

In the paroxysmal form of the disease the symptoms may last only a few hours or may be prolonged for a number of days to be terminated by treat-

ment or in an attack of vomiting. In the continuous type the pain is more marked and, if untreated, the patient may lose flesh and strength. In long standing instances anæmia is not rare.

The prognosis as regards improvement is very favorable and cures are not infrequent.

The diagnosis can be made certainly only by means of chemical analysis of the gastric contents. A test-meal removed two or three hours after ingestion will consist of a small amount of thoroughly digested food containing an excess—sometimes very large—of combined, and especially, free, hydrochloric acid. If the stomach is washed and several hours later—nothing having been ingested in the meantime—the contents of the organ is expressed this will be found to consist chiefly of gastric juice, where normally none should be present.

Treatment. The neutralization of the excessive acidity present in the stomach by means of the alkaline carbonates—sodium bicarbonate in particular—has its disadvantages, the resulting sodium chloride from the combination of sodium bicarbonate and hydrochloric acid being ready for formation into still more of the offending substance; however, certain observers claim that benefit results from the administration of considerable doses of sodium bicarbonate—10 to 30 grains (0.66–2.0)—after meals; a far preferable antacid, however, is heavy magnesia which results in the formation of magnesium chloride which acts as a laxative and is carried off from the body. Some clinicians prefer to give it with sodium bicarbonate, but it is better administered in a combination such as the following: ℞ magnesii ponderosi, gr. x (0.66); pulveris rhei, gr. v (0.33); extracti belladonnæ, gr. $\frac{3}{10}$ (0.018); to be taken ½ to 1 hour after each meal. Sodium bicarbonate in amount equal to that of the magnesia may sometimes be added with benefit. Other useful formulæ are: ℞ potassii carbonatis, magnesii ponderosi aa gr. xii (0.75); extracti belladonnæ gr. $\frac{3}{10}$ (0.018); sacchari lactis gr. xv (1.0). Misce et signa, to be taken about an hour after meals. Sodium bicarbonate may be added to this formula also. ℞ sodii bicarbonatis, cretæ præparatæ, magnesii carbonatis aa gr. iii (0.2). Misce et signa, to be taken after meals.

Belladonna is said to lessen the secretion of the gastric juice and it and atropine are also useful in combating the severe pain. This symptom may be rendered less distressing by various narcotic drugs as well, codeine and strontium, ammonium or sodium bromide being most frequently prescribed. Morphine should not be administered.

Pain which resists drug treatment may be relieved by gastric lavage, which removes the hyperacid contents of the stomach. To the last of the water used it is well to add sodium bicarbonate. Washing with a mixture containing bismuth subgallate and bismuth subcarbonate of each 1 drachm (4.0) to the quart (litre) of water is an excellent measure.

Intra-gastric sprays of silver nitrate solution (1–1000) are said to have the double effect of lessening the secretion and relieving the discomfort. Following this procedure the stomach should be washed with warm water.

The drinking of considerable quantities of Carlsbad water, natural or artificial, tends to lessen the production of hydrochloric acid by the stomach and in hypochlorhydria in lithæmic subjects the use of artificial effervescent solutions made according to the following formulæ is beneficial.

	a.	*b.*
Sodium bicarbonate	℥ii (8.0).	gr. lxxv (5.0).
Sodium borate	℥ss (2.0).	gr. xv (1.0).
Sodium salicylate	gr. xxxvii (2.5).	℥ss (2.0).

Each of these mixtures is to be added to a quart (litre) of ordinary carbonic water and before breakfast a half tumbler of solution *a* is to be taken. After meals a half tumbler of solution *b* should be drunk.

Constipation usually yields to the treatment directed at the neutralization of the acidity. If obstinate, the saline waters, abdominal massage, intestinal lavage and the preparations of rhubarb will prove effectual.

Electricity in the form of intra-gastric galvanism may be employed, the anode to be applied inside the stomach, which should be partially filled with lukewarm water, while the cathode is placed upon the epigastrium or back.

Diet. Certain clinicians advocate a diet consisting chiefly of proteid substances, since the albuminous foods combine with the excessive hydrochloric acid, while others consider much carbohydrate and little proteid to be better adapted to the gastric condition because the latter class of foods tends to cause increased hydrochloric acid secretion, but the proper method of deciding upon a suitable diet in these cases is to study each patient. It is probably true, however, that more patients will do well upon a diet principally of proteid. Of the meats, beef, mutton, veal, pork, raw or cooked ham and fowl are allowable, as are eggs, Roquefort and Swiss cheese, cocoa and milk. Fats are not contra-indicated but it is generally considered that vegetables containing large amounts of starch are better omitted. Since the period of starch digestion is shortened, owing to the abnormally early secretion of hydrochloric acid after the ingestion of food in this condition, starchy foods should be eaten, when possible, dextrinized, toast, zwieback and the like being preferable to plain bread.

Coffee, beer or other alcoholics should be forbidden but the drinking of considerable quantities of alkaline waters with meals is permissible since by this means the excessive gastric juice is diluted.

All substances likely to increase the secretion of gastric juice, such as condiments, spices, fruits containing seeds or enveloped in skins, etc., should not be eaten and the food should be taken finely divided and neither very hot

nor very cold. The patient should be advised to masticate thoroughly so that mouth-digestion may be as fully accomplished as possible. The chewing between meals of substances calculated to excite the secretion of saliva has been advocated with the idea that the swallowing of this secretion in large amounts tends to neutralize the gastric acidity, but is of slight value.

An attack of pain after the evening meal may be relieved by a glass of warm milk, a cup of broth containing an egg, a soft boiled egg or some raw ham finely scraped. Any of these substances takes up a large quantity of hydrochloric acid.

The treatment of paroxysmal hyperchlorhydria consists in the employment during the attack of the means suggested for chronic hyperacidity on p. 383, together with gastric lavage and the application of a mustard paste or hot water bag to the epigastrium. Strontium bromide or ammonium bromide, ½ drachm (2.0) three times a day is said to shorten and to lessen the frequency of the paroxysms. The general management of the condition consists in abstention from mental over-activity and in regulation of diet and exercise.

Alcohol, tobacco, coffee and all other stimulants should be interdicted and a life of recreation and free from care and worry should be ordered, and exercise out of doors—the bicycle, golf, tennis, riding, swimming, etc.—should be advised. Dietetically and otherwise the treatment may be carried out along the lines laid down for continuous hyperchlorhydria.

HYPOCHLORHYDRIA.

Hypochlorhydria, subacidity or hypochylia, is a condition of the stomach in which the gastric juice contains an abnormally small amount of hydrochloric acid and also of the digestive ferments. It exists in various abnormalities of the organ, such as gastritis and cancer, in anæmic conditions, during the infectious diseases and in neurotic states; the subacidity of these last conditions, the true nervous hypochylia, occurs in hysteria, locomotor ataxia, etc.

Entire absence of hydrochloric acid which is denominated *achylia gastrica* occurs in hysteria and neurasthenia, in carcinoma, and as a result of the atrophy of the gastric glands due to chronic inflammations.

The symptoms of diminution or entire absence of hydrochloric acid and gastric ferments are not typical and the condition may exist for long periods without causing complaint on the part of the patient; when, however, in addition to the secretory disturbance, the motor power of the organ is impaired, the consequent fermentation of stagnant food results in distention, eructations, sensations of weight and fullness and at times marked gastralgia. Diarrhœa may be present.

The diagnosis can be made only on chemical examination of the stomach

contents withdrawn after a test-meal. This shows diminution or entire absence of both free and combined hydrochloric acid and of the gastric ferments. Lactic acid is rarely found in nervous hypoacidity.

The treatment of both hypochylia and achylia consists in the administration of dilute hydrochloric acid to supply the lack of this substance in the stomach. The dose should be regulated with regard to the amount present in the gastric secretion. When the acid is wholly absent as much as 15 to 20 drops (1.0–1.33) may be given half hourly after meals until 3 doses have been taken. It must be plentifully diluted and taken through a tube. The administration of pepsin, pancreatin, and especially of fresh pineapple juice, which contains a digestive ferment, may supply the loss of the normal digestive ferments.

Loss of appetite may be relieved by basic orexin and by gastric lavage with solutions of the vegetable bitters such as gentian or quassia. In atony of the gastric musculature strychnine nitrate in large doses—gr. $\frac{1}{30}$ to $\frac{1}{20}$ (0.002–0.003) is indicated and this drug also exerts a favorable action upon any co-existent neurotic condition. Stagnated and decomposed food should be washed out and the stomach irrigated with a disinfectant solution (see p. 352); electricity and hydrotherapeutic procedures are useful adjuncts to the treatment.

The diet should be adapted to the digestive capabilities of each patient. Meat need not be interdicted, in fact it is better that the patient eat some meat, this should, however, be taken in a finely divided condition. Green vegetables and purée soups may be taken; fats in the form of cream and butter are allowable unless they cause fermentation. Salty substances such as anchovy paste, caviar, etc., taken before meals in small quantities, increase both the appetite and the gastric secretion.

CARDIOSPASM.

Synonym Cramp of the Cardia.

This is a spasmodic contraction of the gastric musculature at the cardiac end of the stomach and is usually the result of some irritation such as hyperacidity, or distention of the stomach by air or gas. It also occurs as a symptom of neurasthenic and hysterical conditions and very rarely as a true neurosis of the motor system of the organ. It exists in an acute and in a chronic form; the former appears paroxysmally and lasts but a short time, the latter is a serious condition and one difficult of management. The acute variety, when occurring in an empty stomach, gives no symptoms; on a full stomach it produces a spasmodic and cramp-like pain which soon passes; if food or drink is taken during the cramp there may be obstruction to deglutition. In the chronic form the patient may also have difficulty in swallowing and feel that the food stops before entering the stomach. If he continues to eat the

œsophagus gradually fills and finally the food is regurgitated little changed and containing no gastric juice. The inability of food to reach the stomach brings on a progressive emaciation which is likely to cause suspicion of carcinoma, and the accumulation of ingesta in the œsophagus may result in dilatation or diverticulum formation. There is likely to be obstruction to the passage of the stomach tube.

Treatment. This consists in the appropriate treatment of any co-existent inflammation or secretory disorder of the stomach. The food should be non-irritant, easily digestible and taken in finely divided form. In the severer grades of this condition milk diet or feeding through the stomach tube may be necessary although it is stated that at times solids are more easily swallowed than liquids. Any constitutional neurotic condition should receive proper treatment. The insertion of a firm tube of good size through the cardiac orifice and allowing it to remain in place for a half hour at a time is an approved method of treatment. Before eating, the gastric mucosa at the cardia may be cocainized by a small sponge fixed at the extremity of a stomach tube by means of a thread passed through the tube. The sponge should be saturated with 2–4 percent. cocaine hydrochloride solution, the tube passed as far as the cardia and the cocaine solution expressed by pulling the thread. An intra-gastric spray of cocaine, or cocaine and menthol solution may also be employed to produce anæsthesia. The use of the galvanic current is an excellent measure in chronic spasm; the anode is introduced into the cardia, the location of which has previously been ascertained by measurement, the cathode is applied to the back of the neck and a current of about 25 milliamperes is employed for 10 minutes; the anode is then placed over the stomach and the cathode within the cardia and the process repeated.

PYLOROSPASM.

This condition is analogous to cardiospasm, but takes place at the pyloric extremity of the stomach. It occurs in excessively acid states of the organ, accompanying gastric dilatation, as a result of the action of caustics, and as a concomitant of pyloric ulcer or cancer.

The interference with the passage of stomach contents through the pylorus results in stagnation and fermentation and finally in dilatation with the accompanying symptoms of these conditions. In thin subjects the gastric peristalsis may be visible and in some instances reversed peristalsis with vomiting takes place.

Treatment consists in the exhibition of sedatives, such as the bromides, strontium bromide, 15 to 20 grains (1.0–1.33), codeine phosphate, $\frac{1}{4}$ to $\frac{1}{2}$ a grain (0.016–0.03) or extract of belladonna, $\frac{1}{4}$ to $\frac{1}{2}$ a grain (0.016–0.03) three times a day. Hydrated chloral may be used but is dangerous because of the

possibility of establishing the habit. The spasm may be controlled by the intra-gastric cocaine spray, and intubation of the pylorus, allowing the tube to remain in place for about 10 minutes, is recommended. The galvanic current may be used as described under the treatment of cardiospasm. All food which may irritate the stomach, and over-burdening the organ with large amounts of food should be avoided.

GASTRIC HYPERPERISTALSIS.

Synonym. Peristaltic Unrest.

This is a condition characterized by rapid and continuous contractions of the stomach. The movements are most marked after meals, but sometimes occur when the stomach is empty and may persist through the night. Little or no pain is present but the patient complains of uncomfortable sensations referred to the stomach. Gastric hyperperistalsis is the result of an increased irritability of the sensory or motor nerves of the organ due to a reflex resulting from gastric hyperæsthesia or to irritation from excessive acidity, fermentation or distention; it may occur with pyloric stenosis.

The contractions may be felt by the examiner's hand and at times when very active, may be seen as well. The symptoms are loss of appetite, eructations, nausea and vomiting. In severe instances the patient may lose flesh and strength and the continuous discomfort brings on a neurotic condition. At times the small intestine may take part in the excessive peristalsis and cause the regurgitation into the stomach and even the vomiting of intestinal contents.

Treatment. The drug treatment is identical with that of pyloric spasm and the patient should be advised to lead a regular and quiet life, avoiding mental and physical exertion. Intra-gastric galvanism and hydrotherapeutic procedures are useful adjuvants. Only easily digestible foods should be allowed in order to avoid all irritation of the stomach and possibility of distention by means of fermentation products. A rest cure with rectal alimentation continued for a fortnight may bring about good results in severe instances.

MERYCISM OR RUMINATION.

Definition. This is a condition in which the patient voluntarily causes his food to return to the mouth where it undergoes further mastication and is swallowed again or expectorated.

It occurs in individuals of neurotic habit as a rule and in marked instances the food is regurgitated after every meal, the patient often asserting that the act causes pleasant sensations.

The condition of the gastric secretions is not uniform but a subacidity seems to exist in most patients.

Treatment consists in the correction of secretory disorders by the use of hydrochloric acid or alkalies as the case may be. The patient's nervous and general condition should receive attention and he should be enjoined to masticate slowly and thoroughly. He should be encouraged to resist the impulse to raise his food and to combat the habit with the utmost strength of his will. Bits of cracked ice taken after meals are said to be useful and intra-gastric electricity may be employed. The administration of 10 grains (0.66) of quinine sulphate after each meal may break the habit by rendering the food unpleasantly bitter.

The diet of these patients should consist chiefly of easily-digested fluids and semi-solids.

NERVOUS ERUCTATION OF GAS.

This symptom is often seen in hysterical and neurasthenic patients. The gas raised is usually tasteless and consists chiefly of swallowed air, and various gastric symptoms may or not be co-existent. The belching frequently occurs in paroxysms but at times is almost continuous.

Treatment consists in teaching the patient to guard against swallowing air. This is a habit which a little thought and attention on his part can stop; keeping the mouth continuously open for a half hour or so at a time may be tried for air cannot be swallowed when the mouth is open. The neurasthenic or hysterical condition should receive general treatment to which massage and hydrotherapeutic measures are useful adjuncts. The bromides, arsenic and belladonna may be employed, and the following pill may be found effectual: ℞ extracti physostigmatis, gr. $\frac{1}{10}$ (0.006); extracti belladonnæ, gr. $\frac{1}{5}$ (0.012); strychninæ sulphatis, gr. $\frac{1}{40}$ (0.0015). Signa; one pill three times a day.

Purinæmic conditions may result in neurasthenia and when such are accompanied by nervous eructation the treatment is plainly that of the causative factor.

GASTRIC HYPERÆSTHESIA.

This is a sensory disturbance of the stomach in which the ingestion of food results in pain referred to the organ, at times so great as to cause reluctance on the part of the patient to eat. Hysterical individuals may assert that only certain articles of food cause the distress while others may be eaten with impunity. This neurosis often occurs in anæmic and chlorotic conditions, after periods of over-eating or indulgence in indigestible foods and as a result of sexual or alcoholic excesses.

Another cause is hyperacidity and the condition may also exist in organic nervous diseases such as locomotor ataxia.

Symptoms. These are distress after eating and nausea, often followed by vomiting. When the stomach is empty they are absent. Often pulsation of the aorta is complained of and constipation is usually present. Diffuse tenderness over the region of the stomach is frequently observed and other nervous manifestations, such as headache and various neuralgias, are common. Examination of the stomach contents reveals nothing characteristic.

Treatment. Attention should be given to the constitutional condition, if this is the causative factor, and a rest cure is frequently effectual. The pain itself may be controlled by hot applications and the use of an intra-gastric spray of cocaine and menthol, care being taken to control the amount of the former drug. Intra-gastric galvanism is appropriate, and, when the intra-gastric electrode cannot be used, external galvanism with the electrodes applied to the abdomen may be employed. Silver nitrate gr. $\frac{1}{4}$ (0.016) in 2 drachms (8.0) of peppermint water taken in water a half hour before each meal has been suggested, and the bromides and codeine may produce good results.

The diet should at first be of milk taken a small quantity at a time. Later, as the condition becomes ameliorated, eggs and semi-solids may be allowed, and finally a return to solid food may be permitted. Later massage, hydro-therapeutic measures, moderate exercise, and a change of climate are to be recommended.

Alcohol, tobacco and the abuse of tea and coffee should be forbidden.

GASTRALGIA.

Synonyms. Gastrodynia; Gastric Neuralgia.

This is an affection characterized by severe paroxysmal pain referred to the stomach. The pain may be localized in the epigastrium or may radiate to any part of the abdomen or to the back. It occurs in motor and secretory neuroses, and in various other gastric lesions such as ulcer and cancer, in certain nervous diseases, such as tabes dorsalis, during infectious diseases, especially malaria, in nervous and hysterical conditions and as a reflex pain the result of diseases of the genito-urinary organs, particularly in women.

Idiopathic gastralgia occurs in chlorotic and anæmic states, in convalescent conditions, nephritis and various toxæmias, and especially in incipient pulmonary tuberculosis. The fact that it often manifests itself in early phthisis is responsible for much mistaken diagnosis and treatment, many of these patients putting themselves in the hands of the gastrologist who is apt to miss the true causative factor of the condition.

The attacks of pain usually begin suddenly and are at times so severe as to be almost unendurable, perspiration appears upon the forehead, the pulse is weak and may be faster or slower than normal. There may be suppression of urine; the bowels are usually constipated. The patient is much prostrated.

As the severity of the paroxysm wanes the patient begins to yawn, belches gas and may vomit.

Treatment consists in the proper management of the underlying cause when this can be ascertained. If no cause can be found symptomatic treatment must be instituted. Various analgesic drugs such as codeine sulphate, ½ grain (0.03) every 3 or 4 hours, chloroform water, 1 to 2 drachms (4.0–8.0), hydrated chloral, 10 to 15 grains (0.66–1.0), hyoscyamus, belladonna, etc., may be employed. To patients with cardiac depression compound spirit of æther may be given and stimulation by means of aromatic spirit of ammonia or alcohol may be necessary. Acetanilide, methyl acetanilide (exalgin), pyramidon (a derivation of antipyrine) and other anti-neuralgics are recommended. In instances characterized by very severe pain opium may be employed but only with the greatest caution lest the habit become formed. It is best given in the form of opium and belladonna suppositories or hypodermatically as morphine sulphate in connection with atropine. These drugs are useful only in lessening the patient's pain and have no curative effect; the routine employment of electricity is an excellent method of treatment. The faradic current may be employed but the galvanic is likely to accomplish better results, a current of 25 milliamperes at least, being necessary. Large flat electrodes are used, they are moistened in water as hot as can be borne and applied, the anode to the epigastrium and the cathode to the inter-scapular region. Gastric lavage with a mixture of a pint (500.0) of camphor water, and bismuth subgallate ℥i (4.0), and bismuth subnitrate ℥ii (8.0) is said to be efficacious. The camphor water should be measured as it returns and not more than an ounce (30.0) allowed to remain in the stomach.

The diet should consist of easily digestible foods. Spices, condiments, alcohol and excessive amounts of tea and coffee are to be avoided.

BULIMIA.

Synonym. Hyperorexia.

Bulimia is a condition characterized by an excessively large appetite. It occurs chiefly in persons affected with functional or organic nervous disease such as hysteria, epilepsy, brain tumors, etc., with intestinal parasites, uterine diseases and various gastric conditions. The hunger comes on suddenly, at times even directly after a full meal. The symptom is almost irresistible and if it is not appeased palpitation of the heart, paleness, faintness, noises in the ears and gastric pain ensue. In some patients even small amounts of food suffice to cause a disappearance of the symptoms.

Treatment must be instituted with a view to improvement in the cause of the neurosis. The nervous system, the genito-urinary system, the stomach or whatever part may be at fault must receive appropriate treatment. The

bromides are useful, Fowler's solution in doses increased to the limit of tolerance is recommended and the administration three times a day of one drachm (4.0) of camphorated tincture of opium or of 2 drops (0.13) of the tincture of belladonna in 2 or 3 drachms (8.0–12.0) of simple elixir may prove effectual.

Gastric atony, if present, may be treated by massage and strychnine, and intra-gastric faradism should achieve good results. Lavage with warm and cold water alternately may be employed.

ANOREXIA NERVOSA.

Nervous anorexia is a state in which the appetite is wholly lost and the sense of hunger unknown. This manifestation may last for months, even while the digestive apparatus is perfectly normal in condition. The neurosis is more commonly seen in female subjects and is predisposed to by hysteric and neurasthenic conditions. It also occurs in chlorosis and in individuals addicted to the abuse of drugs, especially alcohol, tobacco and opium. The degree of the distaste for food determines the prognosis of the affection. Those subject to this manifestation become progressively anæmic and lose flesh and strength, the pulse is weak, the extremities are cold. Insomnia is common. The diagnosis of the affection is simple but that of its cause is more difficult.

Treatment consists in combating the anæmia and the nervous condition by appropriate medication and in properly managing any co-existent organic disease. The rest cure—putting the patient away from outside influences and in the hands of a trained attendant, and over-feeding him—is an excellent method; in this connection electrical and balneo-therapeutic measures and massage are to be employed, as well as any means in the line of suggestion that the physician may be able to use. If the refusal to eat is carried to extremes there should be no hesitancy in employing forced feeding by gavage. If the repugnance to taking food is due to discomfort attendant upon this act the administration of sodium bromide—10 to 15 grains (0.66–1.0)—before meals may overcome this disinclination. Orexin—5 to 10 grains (0.33–0.66)—before such meals in a little warm bouillon may cause a distinct increase in appetite and the following formulæ may be found useful: ℞ tincturæ cinchonæ, ℥ss (2.0); acidi sulphurici diluti, ♏vii (0.5); syrupi zingiberis, ℥iiss (14.0). Misce et signa, take before meals through a tube in a claret glass of water. ℞ fluidextracti condurango, ♏xlv (3.0); strychninæ sulphatis, gr. $\frac{1}{10}$ (0.0015); acidi hydrochlorici diluti, ♏x (0.66); elixiris gentianæ, q.s. ad ℥ss (15.00). Misce et signa, take in wine glass of water before each meal through a tube.

CYCLIC VOMITING.

Definition. Cyclic, paroxysmal, periodic or recurrent vomiting is a condition seen in children and characterized by the sudden appearance of violent

and persistent emesis which may persist long after the stomach has been entirely emptied. The attacks usually appear when the child is about two years old and recur with a lessening degree of frequency as puberty approaches when they cease. The intervals vary in different patients, being from a few weeks to a few months, and at times the vomiting is so severe and continuous as to bring about a condition of collapse which has been known to result fatally. The ætiology of this condition is not definitely known but it is probable that it is a disorder of metabolism. Both acetone and diacetic acid have been found in the urine preceding or during the attack.

Treatment at times will be found to have little effect but the administration of large doses of sodium bicarbonate—100 to 125 grains (6.66–8.33) per day—is the most approved means and may succeed in aborting or cutting short the paroxysm. It has been suggested that fats—except fresh butter—are not well borne by patients subject to this manifestation and that too large a carbohydrate content in the diet may produce digestive changes which favor the occurrence of the vomiting. During the attack it is better not to attempt to feed the patient but if the paroxysm is protracted rectal feeding may be instituted and at all times it is well to administer water by this route to allay the thirst—6 to 8 ounces (300.0–500.0) 4 or 5 times a day being sufficient quantity. When the attack has ceased the first foods allowed may be broths, small amounts of cold milk and lime water, equal parts, and barley water. Attention should be given to the patient's general hygiene during the intervals of the paroxysms.

HÆMATEMESIS.

The vomiting of blood is a symptom of various morbid conditions of the stomach and has been discussed at length in the sections devoted to the different affections in which it occurs. It results from the rupture into the viscus of blood-vessels in its walls, from the regurgitation of blood from the intestine or from the swallowing of blood—later to be vomited—which has been extravasated from vessels of the nose, pharynx, or œsophagus. That blood may be raised from the respiratory tract, swallowed and finally vomited must not be forgotten.

Hæmatemesis occurs in injuries of the stomach, either from outside traumatism or as a result of the ingestion of caustic substances, in neoplasms of the organ, in diseases of the organ, such as gastritis of any kind, ulcer, etc., in diseases of other organs, notably hepatic cirrhosis, in malignant forms of the infectious diseases, yellow fever, smallpox, etc., and in constitutional diseases such as purpura, hæmophilia and pernicious anæmia. Vomiting of blood has been observed after the rupture of aneurysms into the œsophagus.

The condition of the blood vomited depends upon the length of time which

it has lain in the stomach. If fresh it may be bright in color and otherwise little changed. If it has been subjected to the action of the gastric juice it is likely to be dark and may be of "coffee-ground" appearance. The differentiation of hæmatemesis from hæmoptysis may generally be made on the following points: Vomited blood is usually dark in color, not frothy, and often is acid in reaction, while blood from the respiratory tract is light red or pinkish, is likely to contain an admixture of air and is consequently frothy, and is alkaline in reaction. In hæmoptysis the stools are not "tarry," while in gastric hæmorrhage the blood which has passed through the pylorus appears in the stools, imparting to them a black color.

The symptoms of gastric hæmorrhage are those of loss of blood from any other part, viz., paleness, prostration, rapid, feeble pulse, subnormal temperature, air hunger, depression, faintness, and cold clammy skin. Fortunately death, from this cause primarily, seldom occurs.

The treatment of hæmatemesis has been fully dealt with in the section relating to the management of gastric ulcer (p. 365).

DISEASES OF THE INTESTINE.

SIMPLE ACUTE CATARRHAL ENTERITIS.

Synonyms. Acute Diarrhœa; Acute Intestinal Catarrh; Acute Ileo-colitis.

Definition. An acute inflammation involving the small intestine and at times the upper portion of the colon.

Ætiology. This disease is more common during the hot months and especially in children. The heat is not so much a direct cause as it is a predisposing one, since it diminishes the bodily resistance and increases the susceptibility of the intestinal tract to the influences of over-eating or improper food. Acute intestinal catarrh often follows excessive indulgence in food or drink, particularly if the substances taken are impure, such as unripe or decayed fruit, decomposed food, contaminated drinking water or the like. The ingestion of irritant drugs such as mercury bichloride or arsenic may cause intestinal inflammations and the condition is also predisposed to by any sudden chilling of the body. Excessive or diminished secretion of bile may be mentioned as causes, the latter since it may favor fermentation by depriving the intestine of the supposed antiseptic effect of this fluid.

Enteritis often accompanies certain of the infectious diseases and is predisposed to by conditions of congestion of the intestine such as occur in cardiac and hepatic lesions and by inflammations of adjoining structures such as the peritonæum. Chronic wasting disease, tuberculosis, cancerous states, anæmia, etc., may be complicated by acute diarrhœa.

Pathology. The mucous membrane lining the intestine is first congested,

red and swollen; the secretion is at first diminished but later there is an excessive production of mucus with exfoliation of the epithelial cells; the solitary follicles are hyperæmic and swollen and may become filled with pus; such tiny abscesses may rupture leaving ulcerating surfaces. In severe forms of the inflammation the agminated follicles also may be involved in like manner. Chronic inflammation may result in rare instances.

Symptoms. Diarrhœa is the most characteristic of these. The evacuations at first consist of ordinary fæcal matter, but as they continue they contain bile, mucus, and finally become watery. In severe instances blood may be present. They vary in number from 5 or 6 to 15 or 20 per day, and may be accompanied by colicky pain and tenesmus. They are likely to be foul at first and accompanied by gas, later they may lose their odor. Loss of appetite is the rule and nausea and vomiting may be present. A rise of temperature of 2 or 3 degrees F. may accompany the diarrhœa, and thirst and diminished urine are noted as a result of the loss of water through the intestinal tract.

Physical examination reveals little more than slight diffuse abdominal tenderness, meteorism and gurglings in the intestine.

When the inflammation is localized various symptoms may call attention to probable involvement of particular portions of the intestinal tract. If the skin, conjunctivæ and urine are colored with bile pigment it is probable that the inflammation particularly affects the duodenum. If the jejunum and ileum are involved to the exclusion of the large intestine diarrhœa is absent, but the pain, distention and other symptoms are present; the diagnosis of inflammations affecting this portion of the alimentary tract alone is difficult and of little practical value. When the morbid condition involves both the small and large intestine mucus is present and may be observed distinct and separate from the fæces which may contain bits of undigested food. The diagnosis of acute intestinal catarrh should present no great difficulties; it may be differentiated from enteric fever by its short duration, lack of characteristic temperature curve, absence of exanthem and of Widal reaction. The condition is not a serious one, recovery under proper treatment taking place within a few days.

Treatment. In mild instances the patient need not be confined to his bed but should refrain from exertion of any sort. Certain patients need no treatment further than a strict milk diet, for as soon as the intestine has by its own action rid itself of the cause of the inflammation, spontaneous recovery takes place. In most instances, however, it is better to aid nature by administering a laxative which shall hasten the passage of the offending substance. The laxatives most often used are calomel and castor oil. The former is best given in doses of $\frac{1}{4}$ to $\frac{1}{2}$ a grain (0.016–0.03) every half hour until 6 doses are taken, it exercises, in addition to its purgative action. an antiseptic effect upon

the intestine, while castor oil, which should be given in single dose of 2 to 4 drachms (8.0–16.0), has the advantage of a slightly constipating after-effect. The emptying of the bowel may be facilitated, especially in children, by irrigation of this viscus with warm normal saline solution by means of a rectal tube or soft rubber catheter and a fountain syringe.

When intestinal astringents or antiseptics are necessary on account of the prolongation of the diarrhœa, any of the salts of bismuth may be given, the subsalicylate—gr. x to xx (0.66–1.33) every 4 hours—being especially effectual. Bismuth naphtholate (orphol) 5 to 15 grains (0.33–1.0), resorcinol—gr. ii to viii (0.13–0.5)—or phenyl salicylate (salol)—gr. ii to v (0.13–0.33)—may also be employed. If the diarrhœa still persists, opium in sufficient doses of the powder, the tincture or of Dover's powder, as suppositories or in the form of an opium and starch enema—one or two teaspoonsful (4.0 to 8.0) of starch, 1 to 2 grains (0.065–0.13) of powdered opium, 8 ounces (240.0) of warm water, should be given.

For the constipation resulting from the use of opium laxatives need not be given since the bowels will, as a rule, move normally after a few days. The hypodermatic administration of morphine may be necessary in severe instances when frequent vomiting and purging preclude the exhibition of opium by mouth or rectum.

The abdominal pain may be controlled by hot or cold compresses.

Diet. During the first day or two of the attack as little food as possible should be allowed and that preferably in the form of milk. As the condition becomes ameliorated other non-irritating foods such as bouillon, soft boiled eggs, milk toast, etc., may be eaten, to be followed as the diarrhœa ceases, by sweetbreads, calf's brain, scraped beef, meat jellies, the white meat of chicken and mashed potatoes. Green vegetables, fruit and all irritating and indigestible articles of diet should be omitted from the diet for some time.

CHRONIC CATARRHAL ENTERITIS.

Synonyms. Chronic Diarrhœa; Mucous Colitis; Chronic Entero-colitis; Ulcerative Colitis.

Definition. A chronic catarrhal inflammation of the small and large intestine, characterized by the excessive production of mucus, and at times, the development of ulcers.

Ætiology. This disease may follow attacks of acute entero-colitis or of dysentery. The affection may occur primarily, and it is predisposed to by cardiac lesions, hepatic cirrhosis or any other condition attended by chronic hyperæmia of the digestive tract, by conditions of feeble nutrition, purinæmic states, and chronic wasting diseases such as anæmia, nephritis or phthisis. It may follow the infectious diseases, notably malaria and cholera.

Pathology. At first the pathological state is that of acute catarrhal enteritis; these lesions become permanent and in marked instances ulceration of the lymph follicles takes place with consequent hæmorrhage, and, when the ulcers heal, cicatricial contractions which may result in stenosis. Pigmented spots in the diseased mucous membrane are sometimes observed and the destruction of the intestinal glands by the inflammation may result in atrophy of the mucous membrane and at times of the muscular and peritonæal coats of the bowel.

Symptoms. While diarrhœa is the rule in acute entero-colitis, in the chronic form of this inflammation this is not the case. The bowels may be constipated, there may be diarrhœa or there may be an alternation of these conditions. A fairly constant symptom is the presence of mucus in the movements from the bowels. This mucus is variable in quantity, from a small amount mixed with the fæcal matter to large masses discharged in the form of casts of the intestine. If ulceration exists there may blood in the stools.

The type of the disease characterized by the passage of casts of the bowel is seen usually in neurotic women. Constipation is usually present and at intervals stools of the type described above are passed, accompanied by tenesmus and abdominal pain and tenderness.

Subjective symptoms may be wholly absent in chronic entero-colitis, the appetite and gastric digestion are often good but there are at times abdominal discomfort and flatulence.

Physical examination may reveal nothing characteristic, although sometimes tympanites may be detected. When the intestinal contents is fluid palpation may elicit gurglings and in the type of the disease of which constipation is a feature the hard fæcal masses may be made out.

The course of the disease is often long drawn out and the patient may be apparently well save for his intestinal symptoms. Other patients become gradually emaciated and may die from exhaustion rather than from the disease itself.

The prognosis as regards life is good but as to recovery, especially in instances of long standing, it is distinctly bad.

Treatment of this disease is unsatisfactory, consequently many drugs have been recommended as useful. Of these silver nitrate may be mentioned first. Its dosage is ¼ grain (0.016) three times a day, or it may be given in 1 to 1,000 aqueous solution in doses of 2 or 3 drachms (8.0–12.0) three times a day. Other metallic astringents such as copper sulphate, ¼ grain (0.016), lead acetate, 2 grains (0.132), or zinc sulphate, 2 to 4 grains (0.132 to 0.25) may be employed. Other drugs, given with the idea of lessening the diarrhœa by means of inhibiting the fermentive and putrefactive processes going on in the intestine. may be mentioned almost without number. The best of these are the bismuth salts, especially bismuth naphtholate (orphol), 5 to 15 grains (0.33–1), bismuth tribromophenolate, 8 grains (0.5) and bismuth tetraiodo-

phenolphthaleinate, 5 to 8 grains (0.33–0.5). The subsalicylate, the subgallate and the subnitrate may also be employed in doses of 10 grains (0.66) or more, frequently repeated.

The vegetable astringents are less effective than the bismuth salts but in view of their former popularity may be mentioned. What action they exert, for we now know that they do not act as astringents when introduced into the alimentary tract, is due to their tannic acid content. Of these calumba, catechu, rhatany, campeachy wood, and tannic acid may be mentioned. Tannalbin, tannocol and tannigen in doses of 8 to 15 grains (0.5–1.0), as well as the calcium salts—the phosphate, carbonate and salicylate—given in solution in carbonated water, may be employed. Coto—the powder in dosage of 10 grains (0.66), or as cotoin, ½ to 1 grain (0.032–0.065)—is used empirically.

Neurotic diarrhœas due to hysteria, the symptom complex of neurasthenia, migraine, and the climacteric require not only careful management based on the underlying cause but call for a further word of comment. The best results are obtained from the persistent use of the bromides, preferably strontium bromide (free from the barium salts), 60 to 90 grains (4.0–6.0) daily. After 3 days this may be diminished in quantity and the solution of potassium arsenite commenced, 3 drops (0.2) thrice daily and increased 1 drop (0.065) per day until slight untoward symptoms supervene.

Nephritic or uræmic diarrhœa should be recognized as a salutary effort of the organism to rid itself of the poisons whose effects we characterize as "uræmia." The proper method of dealing with this condition is the administration of a high intestinal irrigation of normal sodium chloride solution, in quantity a gallon (4 litres) of a temperature of 112° F. to 116° F. (44.5° to 46.5° C.) through a rectal tube, inserted at least 12 inches, the reservoir being elevated about 3 feet. If the chronic nephritis is predominatingly parenchymatous, the sodium chloride should be replaced by sodium bicarbonate. Intestinal irrigation will free the bowel from irritating contents, will enable the kidneys to functionate normally and will stimulate the heart.

Purinæmic diarrhœas are best combated by 60 grains (4.0) daily of saligenin tannate, regulation of the diet and inhibition of intestinal fermentation by intestinal antiseptics until the proteid metabolism is re-established upon a satisfactory basis.

Malarial diarrhœa is best treated by arsenic, methylthionine hydrochloride (methylene blue) or a combination of extract of ergot, 2 grains (0.13), berberine sulphate 1 grain (0.065) with piperine ½ grain (0.032) 4 times daily.

In patients who have survived the acute onset of cholera, a diarrhœa frequently persists. This is best treated by bismuth tribromophenolate, 90 to 120 grains (6.0–8.0) daily. In addition dried suprarenal extract, 5 grains (0.33) 3 times a day will assist in restoring the vascular tone.

If bile pigment is present in the stools the disturbance is presumably high in the intestine and a combination of salicylic acid, 6 grains (0.40) with the same amount of acid sodium oleate, with 4 grains (0.25) of phenolphthalein and ½ grain (0.032) of menthol, given once daily for several days will disinfect the bile and remove this cause of intestinal indigestion.

The constipation occurring in chronic entero-colitis must never be allowed to persist and should be combated by mild rather than drastic measures. Enemata of warm water, castor oil, calomel or laxative waters such as Hunyadi, Apenta, etc., are the best means of controlling this symptom. Fæcal impactions are best relieved by softening them by quart (litre) injections of warm olive oil, the patient being in the knee-chest position, or drachm (4.0) doses of arsenic-free sodium phosphate twice daily by mouth; $\frac{1}{100}$ of a grain (0.0006) of physostigmine salicylate 3 times a day will enable the intestinal muscularis to recover its tone.

Opium is admissible in the treatment of chronic diarrhœa only, when the alimentary canal has been thoroughly emptied, to check excessive peristalsis. It should be given hypodermatically, as morphine, in substantial doses, and not repeated. A prescription for opium, or any of its preparations or alkaloids, should never be entrusted to patients of the nervous type. There is too great danger of habit formation.

The extract of denarcotized opium and extract of belladonna have been recommended as useful in the relief of the abdominal pain from which some patients suffer but both these drugs should be employed with utmost caution, the former on account of the danger of causing the habit, the latter lest toxic symptoms be induced.

Treatment by means of colonic irrigation is effectual when the chief seat of the inflammation is the large intestine. A soft rubber rectal tube passed high into the bowel and attached to a fountain syringe or a large funnel should be used. Various solutions have been employed in this connection, those preferable being silver nitrate 1–2 to 1,000, boric acid 1 to 100, salicylic acid 2 to 100, tannin 2–4 to 1,000, zinc sulphate 3 to 1,000 and mercury bichloride 1 to 15,000. The last is irritating and if absorbed is likely to produce mercurial intoxication, consequently it should be administered with great caution.

Diet. By far the best diet for chronic entero-colitis is milk, but it cannot be continued indefinitely. The author reserves its use for between meals and at bed time. The first choice is a properly peptonized milk, not taken too cold. For the meals clear meat soups, gruels, eggs, poached on toast, soft-boiled or raw, fresh butter, sweetbreads, calf's brain, rare, grilled or broiled steak or lamb chops, fresh chopped beef, with ½ drachm (2.0) of dilute hydrochloric acid to each 2 ounces (60.0), oysters and fish, toast, hard rolls, mashed potatoes and macaroni, will carry the patient well toward the time when a

regular mixed diet may be resumed. To be avoided are fruits, raw or sour, cooked or sweetened, succulent vegetables, fat meats, all highly seasoned and indigestible foods, foods leaving much residue, and sugar. All dishes should be properly cooked and prepared as simply as possible in every way.

Mineral waters seem to have a certain influence upon chronic intestinal catarrhs. The waters of Carlsbad and Vichy have a considerable vogue among European clinicians and the waters of Saratoga and of the Virginia hot springs of our own country may prove quite as beneficial. Water cures at home are seldom as beneficial as when taken at the springs for the mode of life, regular diet and exercise at these resorts has an additional favorable action upon the lesion.

Aside from sojourns at spas, other changes of climate and scene may benefit the patient.

Hydrotherapeutic procedures have a place in the management of chronic diarrhœas and a course of cold water treatment at an institution frequently acts favorably. Diarrhœas from cold almost invariably may be relieved by the daily use of a morning cold bath. The bath should commence with a temperature of 88° F. (31.1° C.), and be taken cooler by a degree or so each morning until 68° F. (20° C.) or even 58° F. (14.5° C.) is reached. A 5 minute bath followed by a brisk rubbing with a rough towel results in a vigorous reaction, and the morning bath not only soon becomes a therapeutic necessity but a luxury as well. In addition an abdominal bandage of flannel should be constantly worn. Wet abdominal binders and hot or cold compresses are often useful adjuncts to treatment.

CHOLERA MORBUS.

Synonyms. Cholera Nostras; Sporadic Cholera.

Definition. An acute inflammation of the stomach and intestines characterized by profuse emesis, diarrhœa and severe abdominal cramps.

Ætiology. No micro-organism has yet been proven to be the specific cause of this disease although it is possible that it may be of bacterial origin. Until its specific cause is isolated we must consider it to be the result of the ingestion of impure, decomposing or indigestible articles of food, such as decayed or unripe fruit, fish, salads, etc. Attacks of cholera morbus are most frequent during the hot months and seem to be predisposed to by exposure to draughts while the body is over-heated.

Pathology. The morbid conditions found in fatal instances of cholera morbus resemble too closely those of acute enteritis to need separate description.

Symptoms. The onset of cholera morbus frequently takes place in the night. The patient is seized without warning with nausea, followed by

vomiting, profuse diarrhœa and severe abdominal cramps. The vomitus consists at first of the stomach contents followed by bile and later by watery fluid. The stools are often so frequent as to be almost without interval, at first they are of the fæcal matter contained in the bowel but soon become very loose and watery. A rise of temperature is infrequent. Thirst due to the rapid loss of water is marked. The pain is abdominal, paroxysmal and colicky; the muscles of the limbs later become painful; in severe instances the patient may fall into a state of collapse, with marked bodily weakness, cold, clammy skin and weak and rapid heart action.

Death may supervene in rare instances but recovery from the acuity of the attack within half a day is the rule. The depression, weakness and irritability of the digestive tract may last for a few days longer.

Treatment. Since the train of symptoms known as cholera morbus is the result of some irritating substance in the gastro-intestinal tract the first indication in treatment is to get rid of the cause of the offence. This may be done by administering calomel in doses of $\frac{1}{4}$ grain (0.016) every $\frac{1}{2}$ hour until 6 doses have been taken, or castor oil $\frac{1}{2}$ ounce (15.0). In patients with marked and frequent vomiting it may be impossible for medication given by mouth to be retained; here the most approved method of cleansing the intestine is by high rectal irrigations of warm water.

The severe pain may be controlled by the application of counter-irritation by means of the mustard or flax-seed poultice or a capsicum plaster to the abdomen. These should be carefully watched lest they cause blisters. When relief is not brought about by these means the hypodermatic injection of morphine may become necessary but this remedy should be used with the greatest caution.

In the later stages of an attack the use of a prescription such as the following may be indicated: ℞ acidi sulphurici aromatici, ♏vi (0.4); extracti hæmatoxylon, ♏vi (0.4); spiritus chloroformi ♏xii (0.8); fluidextracti ipecacuanhæ, ♏iii (0.2); syrupi zingiberis, q. s. ad ℥i (4.0). Misce et signa, one dose every 2 hours.

The marked thirst must be relieved by supplying water to the tissues either by high rectal enemata of normal saline or by hypodermatoclysis of the same solution. The latter process consists in allowing a pint ($\frac{1}{2}$ litre) or more of saline to run into the tissues through a needle attached to an irrigation apparatus and plunged into the thigh or buttock, the skin of which has been previously sterilized and, if advisable, anæsthetized by means of an ethyl chloride or æther spray. This quantity of the solution will be quickly absorbed and the procedure may be repeated if necessary.

For the vomiting the patient should be given cracked ice to hold in the mouth, sips of iced champagne or carbonated waters. The tendency to collapse necessitates the exhibition of hypodermatic stimulation, strychnine,

camphor and æther, etc., the application of heat to the extremities or wrapping the body in a hot sheet.

Diet. During the acuity of the attack and for a day or more after, the less eaten the better. As the vomiting ceases the patient may begin to take small quantities of milk and lime water or milk mixed with a carbonated mineral water and, as progress toward recovery is made, soups, toast, soft eggs, etc., may be allowed, to be gradually followed by a return to ordinary diet.

DIARRHŒAS OF CHILDREN.

Acute Gastro-enteritis.

Synonyms. Summer Diarrhœa; Gastro-intestinal Catarrh.

Definition. An acute catarrhal inflammation of the gastro-intestinal tract characterized by vomiting, diarrhœa and a febrile movement.

Ætiology. The specific cause of this disease is probably bacterial. Various micro-organisms have been considered to have a part in the production of this condition, namely the colon bacillus, the streptococcus, the staphylococcus, the bacillus pyocyaneus, the bacillus proteus and Shiga's bacillus. The disease is predisposed to by teething, hot weather, unhygienic surroundings and poor bodily condition. The exciting cause seems usually to be improper feeding, either in quantity or quality. Not only bottle-fed babies are subject to the infection but those fed on mother's milk are often attacked, since improper diet, mental excitement, etc., are capable of materially changing the lacteal secretion and thus causing the digestive disturbance.

Pathology. The gross appearance except, for the presence of excessive mucus, is little changed. The mucous lining of the gastro-intestinal tract may either be pale or hyperæmic and the solitary and agminated follicles of the small intestine may be swollen. Patches of congestion may be observed in the large intestine. The intestinal walls are not thickened.

Symptoms. The disease occurs in two chief types, the mild and the severe. In the former the onset is gradual with symptoms of indigestion, little or no rise of temperature, restlessness and fretfulness; the stools become more frequent, are diarrhœal in character, greenish, yellowish or brownish in color, of bad odor and contain undigested food; later mucus appears.

In the second type the onset may be gradual, with symptoms of digestive disturbance, or sudden, with a rapid rise of temperature—102° to 105° F. (38.9° to 40.5° C.)—hot dry skin, restlessness, and vomiting. There may be convulsions or stupor. The thirst is often extreme. The vomitus consists first of undigested food, and if emesis continues after the stomach has become empty, mucus or bile may be vomited. In certain patients the vomiting may be

wholly absent. The diarrhœa may not appear for a number of hours after the onset of the attack. The stools are at first of fæcal matter and are accompanied by colicky pains and gas; later they become thin, watery and foul; in color they are grayish, greenish or brownish. They contain mucus after a few days and may be as many as 15 or 20 during the 24 hours. The child rapidly becomes weak and emaciated; the disease may prove rapidly fatal or the symptoms may abate and the condition become subacute. Relapses are not rare and an entero-colitis may ensue.

Treatment. Prophylaxis, in view of the probable infectious character of the disease, consists in careful attention to the surroundings and hygiene of infants, especially during the summer, the immediate washing or disinfection of all soiled napkins, and, above all, proper feeding, the use of boiled water for drinking purposes and the boiling of bottles and nipples—in the case of artificially fed infants—previous to their use on every occasion. Breast feeding should be encouraged and mothers advised against weaning during the summer.

The treatment of the attack proper consists in measures calculated to relieve the digestive tract of its irritating and toxic contents. If the vomiting is persistent the stomach should be washed by means of a soft rubber catheter of appropriate size attached to a rubber tube of larger calibre and a funnel. The lavage should be continued until the water returns clear and it is wise to leave a little water in the stomach. If the vomitus has been very acid a little sodium bicarbonate may be added to the water left behind. In children who struggle against the stomach tube full draughts of boiled water may be substituted

The small intestine should be relieved of its contents by cathartics. When vomiting is not a feature, castor oil, 2 drachms (8.0), may be given to a child of 1 year while older children may take up to ½ ounce (15.0). Calomel in divided doses of ¼ to ½ a grain (0.016–0.032) should be given every half hour up to 6 doses. The tablets may be dissolved in a teaspoonful of boiled water and are willingly taken.

The colon should be irrigated with warm normal saline solution. Two quarts (litres) should be used and given through a soft catheter passed high into the bowel. This procedure should be carried out twice or thrice during the first day of the attack and once a day thereafter. Drugs are often unnecessary but should they be indicated bismuth subgallate in doses of 3 or 4 grains (0.2–0.25) may be given to a year old child every 3 hours or phenyl salicylate (salol) in doses of 1 to 2 grains (0.065–0.13) may be administered. Antacids, such as lime water, milk of magnesia or chalk mixture, are often useful when hyperacidity of the stomach with fermentation is present.

For patients with marked prostration stimulation is necessary in the form of whiskey or brandy given frequently in small amounts fully diluted. A half ounce (15.0) in divided doses during the 24 hours is not too much for a child

of 1 year. Hot mustard baths and applications of heat are useful and if the diarrhœa has been profuse enough to deprive the system of a large amount of water, this should be supplied by rectal irrigations or by hypodermatoclysis of warm normal saline solution.

Diet. Too great emphasis cannot be laid on the statement that no food should be given for at least 24 hours, or for even longer periods, should the vomiting continue; cold water should be supplied, however, and thin barley water or albumin water (the white of one egg in 8 ounces (250.0) of boiled water) to which a little brandy has been added, are allowable. If these are refused the stomach should be allowed to rest.

Usually after 24 hours the child may be nursed, but for not longer than 2 to 3 minutes, at intervals of at least 4 hours. In the intervals barley or albumin water may be given. Gradually the intervals between breast feeding may be lessened and the length of the nursing prolonged so that in 4 or 5 days the child is fed as usual.

Bottle-fed infants should be deprived of all milk for several days and barley or rice water, artificial malted foods, beef or chicken bouillon substituted. When milk is allowed again it should be boiled, the quantity should be small and the dilution very weak.

During convalescence the child should be carefully watched and if possible a change of climate is advantageous. The climate does not seem to matter particularly, so long as excessively hot neighborhoods are avoided; babies taken from the city to the country do well and *vice versa*. All errors in diet should be studiously guarded against.

Cholera Infantum.

Definition. An acute catarrhal inflammation of the intestinal tract of very severe type characterized by high temperature, profuse diarrhœa and great prostration.

Ætiology. No specific cause for this disease has been isolated but it seems to be closely associated with the decomposition of the intestinal contents, especially if this is impure milk. The predisposing causes are poor general condition, unhealthy surroundings, etc.; they are similar to those of acute gastro-enteritis.

Pathology. *Post mortem* examination reveals no marked abnormality in the affected intestine.

Symptoms. Cholera infantum usually occurs in children in whom there has been previous intestinal disturbance. Prostration and fever are often present before the appearance of the vomiting and diarrhœa. The former may appear first or both it and the purging may occur simultaneously. The emesis is frequent, the vomitus at first consisting of the contents of the

stomach, then of mucus, serous fluid and later bile. It is brought on by the ingestion of any food or drink. The patient is very thirsty and eagerly drinks water only to vomit it almost immediately. The movements from the bowels are copious, greenish, yellowish or brownish and may be as many as 20 or 30 in 24 hours. Their odor is, as a rule, not foul but at times is offensive, and as the disease progresses they become serous.

Nervous symptoms are frequent; at first they are those of excitation of the nervous system, later they may merge into convulsions, stupor or coma. The prostration is marked and emaciation is rapid. The temperature varies with the severity of the attack from 102° to 105° F. (38.9° to 40.5° C.), the pulse and respiration are rapid and weak and at times irregular. In the fatal instances the skin is cold and clammy and the facies typical, the eyes being sunken, the skin pale and the expression anxious to a marked degree. The cerebral symptoms may lead to a mistaken diagnosis of brain lesion, but they are probably the result of the action upon the nervous system of toxins absorbed from the intestine.

In patients in whom recovery takes place the emesis and purging become less frequent, the constitutional symptoms become ameliorated, the temperature falls and the nervous symptoms subside. Convalescence is slow and relapses are very likely to occur.

The prognosis is serious, the outcome in many instances being fatal.

Treatment can hardly be considered satisfactory. The first indication is to relieve the digestive tract of its toxic contents. This is to be done by means of gastric lavage and colonic irrigation as described in the section on chronic catarrhal enteritis (p. 403); the action of purgatives is too delayed. Drugs by mouth are vomited, consequently hypodermatic medication must be undertaken. For the nervous manifestations morphine, gr. $\frac{1}{50}$ to $\frac{1}{100}$ (0.0012–0.0006) with atropine, gr. $\frac{1}{500}$ (0.00013) may be given to a child of 1 year of age and may be repeated in an hour if improvement is not noted. For the pyrexia baths are indicated. They should be begun at 80° F. (26.1° C.) and reduced to 70° F. (21.1° C.), may last from 10 to 30 minutes and may, if necessary, be repeated every hour or two. When baths, for any reason, are impossible, wrapping the patient in a wet sheet, or cold water injections may be substituted, and as an adjunct to the hydrotherapeutic measures, ice compresses or an ice cap should be applied to the head.

To supply the fluid lost by emesis and diarrhœa hypodermatoclysis, given as described under the treatment of acute gastro-enteritis, (p. 401) is indicated. Eight ounces (250.0) or more of normal saline should be administered in this fashion every 12 hours.

There should be no attempt to give food or medication, except stimulants, by the mouth. The patient may suck bits of ice and stimulation by means of brandy or iced champagne—small amounts frequently repeated—may

be administered by this route. If these are not retained hypodermatic stimulation—brandy or whiskey, camphor, æther, etc.—is indicated.

The feeding and convalescence of patients suffering from cholera infantum are to be managed according to the principles laid down under the treatment of acute gastro-enteritis (p. 404).

Much can be done with regard to the prophylaxis of this disease by means of attention to the suggestions on p. 403.

Acute Entero-colitis.

Synonyms. Acute Ileo-colitis; Follicular Enteritis; Dysentery.

Definition. An acute inflammation of the mucous membranes of the ileum and colon chiefly involving the lymph follicles of these structures.

Ætiology. This disease is most frequently seen during the summer. The predisposing causes are the same as those of acute gastro-enteritis. The children affected are usually under 2 years, although the condition may occur up to the 5th year. Recent research seems to have established a definite connection between Shiga's bacillus and this affection, this organism being demonstrable in the stools, and characteristic agglutinative blood reactions being obtainable in a large majority of patients.

Pathology. The colon is the chief seat of the lesions and when the ileum is involved these extend to a distance of but 2 or 3 feet above the ileo-cœcal valve. The mucous membrane is congested and swollen and the solitary and agminated follicles are enlarged. The follicles of the large intestine may go on to ulceration but the agminated follicles of the ileum rarely are subject to this process. The ulcers may penetrate to the muscularis, the wall of the intestine may become infiltrated with small cells and its thickness may be increased to two or three times the normal. There may be small hæmorrhagic spots and the formation of a false membrane may occur. The mesenteric lymph nodes are frequently enlarged.

Symptoms. Ileo-colitis may have its origin in an attack of cholera infantum or acute gastro-enteritis or it may occur as a primary infection. At the onset the symptoms often resemble those of acute indigestion, viz., vomiting, abdominal pain and distention, a rise in temperature and diarrhœa; the stools at first are loose and yellowish or greenish, later they contain mucus and blood, are very frequent and may be accompanied by pain. The mucus may be clear or mixed with fæcal matter. After a week or thereabouts the symptoms may disappear and the patient slowly recover, or they may become more severe, with persistent fever, frequent stools of mucus and blood, pain and tenesmus, loss of appetite and increasing prostration and loss of weight. Nervous symptoms, dry, brown and ulcerated tongue and diminished urine, at times containing albumin and casts, are features of the severe infections.

Such patients may go on in this manner for 4 or 5 weeks and die, or convalescence, which is always very slow and likely to be interrupted by relapses, may become established. Few of these patients recover completely, their powers of resistance being so deteriorated that they are subject to any intercurrent disease and they, as a rule, finally succumb.

Treatment. Prophylaxis consists in early and careful treatment of all intestinal disorders and the employment of the measures suggested under acute gastro-enteritis (p. 403).

The treatment of the attack consists in emptying the gastro-intestinal tract by means of systematic gastric and colonic lavage and the exhibition of cathartics as laid down on p. 403; the pain and restlessness should be controlled by paregoric or the deodorized tincture of opium. Local treatment of the diseased areas in the intestine by means of intestinal irrigations of normal saline solution is important. A quart or two (1000.0–2000.0) of the solution at a temperature of about 102° F. (38.9° C.) being allowed to flow into the bowel and out again through a soft catheter passed as high as possible, two or three times a day. If there is much blood in the stools small injections of hot water—108°–112° F. (42.3°–44.4° C.)—or of ice water are useful and injections of astringents—a drachm (4.0) of tannic acid to the pint (500.0) of warm water—may be employed. If the injections cause the child to struggle they must be omitted. In such instances, and others which do not respond to the injections, bismuth subnitrate in considerable doses—20 grains (1.33) or more every 3 or 4 hours to a child of 1 year—or castor oil in emulsion—10 minims (0.66)—at the same intervals may be administered.

In the later stages good results may attend the use of gelatin which may be employed as follows: 2½ drachms (10.0) of a 10 percent. aqueous sterilized gelatin solution should be warmed and added to the child's bottle. This dosage should be given three times on the first day of its employment—the amount of gelatin taken by the child being 45 grains (3.0) per day—and increased 15 grains (1.0) daily. It is said that this treatment quickly lessens the number of the stools, supposedly by mechanical action.

Attempts at serum treatment have been made but decision as to the benefit to be derived must be reserved at present.

Stimulation is usually necessary. Well diluted brandy is to be preferred with iced champagne as a second choice; of either half a drachm (2.0), or more if necessary, may be given a child of 1 year every 2 or 3 hours. In instances of profound shock atropine sulphate hypodermatically, beginning in doses of $\frac{1}{500}$ of a grain (0.00013), pushed to the limit and followed by brucine has been recommended.

It must be remembered that too much medication is usually much worse than too little, in fact, when the acute symptoms have disappeared and the temperature is but little above normal and the movements are less than 6 a day, patients

frequently do better when all drugs are stopped—save stimulants—and the bowel is irrigated only every second or third day. For such patients a change of air will often effect wonders.

The diet during the acuity of the attack is identical with that described for instnces of acute gastro-enteritis. After the acute stage is over, great difficulties are often experienced and the most judicious feeding is necessary. Each patient must be studied by himself and no fixed rules can be laid down. To infants, foods which may be given are peptonized skim milk, broths, beef peptonoids, barley or rice water and the various artificial malted foods. Feeding by gavage may be necessary in instances of disinclination to eat. Food should not be given oftener than every 2 or 3 hours, but drinking water may be allowed in the intervals.

For older children during convalescence, scraped beef, kumyss, gruels, and soft boiled eggs are allowable. The greatest attention should be given the diet for a long period after an attack since the slightest indiscretion may result in a recurrence of the disease.

Hygienic treatment should be carried out as described under the treatment of acute gastro-enteritis (p. 403).

PSEUDO-MEMBRANOUS ENTERO-COLITIS.

Synonyms. Croupous Entero-colitis; Diphtheritic Entero-colitis.

Definition. An acute inflammation of the lining of the intestine accompanied by the formation of a false membrane.

Ætiology. This disease is probably the result of the irritant action of chemical substances resulting from intestinal fermentation or of infection by bacteria. The former ætiological factor may act in poisoning by mineral substances, such as arsenic, mercury or lead. The condition may also be secondary to various of the infectious diseases such as pyæmia, scarlatina, smallpox, etc. Whether here the intestinal lesion arises directly from infection by the specific organism causing the disease or not is uncertain. Diphtheritic enteritis also occurs as a complication in cachectic states, nephritis, hepatic cirrhosis, etc.

Pathology. Usually only the large intestine is affected but in the instances due to mineral poisons the small intestine may also be involved. Early in the disease the lesions are usually those of simple intestinal catarrh, but more infrequently the membrane is present from the inception of the inflammation. The membrane varies in size and thickness and is grayish white in color. Ulceration may be present with necrosis and perforation or increase in thickness of the intestinal wall.

Symptoms. These are not characteristic and in mild instances they may be unnoticed. Severe instances resemble dysentery (q.v.); the stools are frequent,

thin and accompanied by tenesmus; they may contain blood, pus and bits of the membrane. The course of the disease is greatly influenced by its causation, but it is usually slow. The prognosis is not good, death occurring from exhaustion, peritonitis or hæmorrhage. Patients who recover are often left with permanent intestinal stenoses due to the contraction of the intestinal cicatrices.

Treatment consists in the proper management of the co-existent and causative affection and in the relief of the symptoms as they arise. For details the reader is referred to the sections on the treatment of intestinal ulceration and colitis.

PHLEGMONOUS ENTERITIS.

This is a rare affection. It is probably of infective origin and consists in an infiltration by pus of the intestinal wall. It may follow other intestinal inflammations such as ulceration and has occurred in strangulated hernia and intussusception. Little is definitely known about the disease and diagnosis *ante mortem* is considered impossible.

HÆMORRHAGIC INFARCT OF THE BOWEL.

Definition. An extravasation of blood into the intestinal wall resulting from thrombosis or embolism of one of the mesenteric arteries or one of their branches.

Ætiology. The causes of intestinal embolism are identical with those of embolism of any other part, namely valvular heart disease, aneurysm, etc.

Pathology. The walls of the jejunum and ileum are congested and swollen and a clot obstructing either the superior or inferior (usually the former) mesenteric artery or one of their branches is demonstrable.

Congestion and infiltration may also be observed in the mesentery.

Symptoms. Of these the most important is hæmorrhage from the bowel. The onset of the affection is usually marked by sudden nausea followed by vomiting, colicky pain and abdominal distention. The bowels are loose and the movements may contain blood from the beginning or not until later. Instances in which the symptoms closely resemble those of obstruction are more rare. The prognosis is bad although recovery is possible through the establishment of a collateral circulation.

Treatment is unsatisfactory it being limited to the relief of the symptoms and the diminution of the excessive blood pressure in the portal circulation by means of cardiac stimulation and venesection.

Surgical interference—resection followed by enterostomy—has been successful in a few instances.

ULCERATION OF THE BOWEL.

Ulcer of the Duodenum.

Ætiology. Duodenal ulcer probably occurs more often than is generally supposed and is produced by the same causes as those which result in gastric ulcer, with which it may be associated. Its chief ætiological factors are traumatism resulting from foreign bodies, excessive gastric acidity, local infection, embolism or thrombosis in the duodenal wall, with consequent tissue necrosis, and severe skin affections such as burns, erysipelas, etc. Ulcer of the duodenum, however, is much less frequent than gastric ulcer.

Pathology. The morbid anatomy is similar to that of gastric ulcer (q.v.) in every way both in gross appearance and under the microscope. The lesion may be single or multiple and is usually in the first portion of the duodenum. Perforation takes place more frequently than in gastric ulcer and general or localized peritonitis walled off by adhesions, results. When the adhesions involve the neighboring organs perforation into these may occur.

Symptoms. These are so little characteristic as to render diagnosis very difficult and often when they are sufficiently marked to raise suspicion they are so analogous to those of ulcer of the stomach that differentiation from the latter lesion may be well-nigh out of the question. The most important symptoms are pain and hæmorrhage. The former, however, may be absent or so insignificant as to attract little notice from the patient; it is usually less severe than that of gastric ulcer and is likely to appear at a longer interval after eating, though this latter statement is doubted by some authorities. Hæmorrhage is not rare, and varies from a quantity so slight as to be hardly noticed to a considerable amount which is either vomited, leaves the body through the intestine or is carried off by both these routes. The vomited blood is similar to that of gastric ulcer, while that passed in the stools is black and tarry.

Jaundice may occur, but is so infrequent as to cause doubt on the part of some observers as to whether it is a part of the clinical picture or merely a coincidence.

Vomiting is not a common symptom; it may appear as a result of a co-existent gastric inflammation or be due to duodenal obstruction resulting from the cicatricial contraction of an old ulcer. The vomitus and the stomach contents in duodenal ulcer are not typical in any way.

The appetite is often excellent; the bowels are usually constipated but may be entirely normal in their action.

Perforation induces the usual symptoms of intestinal rupture, either those of general or localized peritonitis.

The prognosis is not good as regards recovery. In non-perforative instances the symptoms may continue for years despite treatment and in perforative in-

stances, without adhesions to wall off the general abdominal cavity, death is certain, unless immediate operation is undertaken.

Treatment is practically that of gastric ulcer (p. 361) as regards both medical and surgical measures.

Primary Tuberculous Ulceration of the Intestine.

This is a rare condition and one seldom seen in the absence of tuberculous lesions in other parts of the body, still it may occur under these circumstances. The condition is seen, as a rule, in children. The ulcers are situated in the small intestine and the rectum, seldom in the colon. They begin in the agminated follicles as tubercles which undergo caseation and finally ulcer formation. The ulcers are irregularly oval, their longer diameter is parallel to the transverse axis of the intestine, their edges are undermined and there is thickening of the peritonæal coat. Unless in the rectum where they may be seen by means of the proctoscope their existence cannot be certainly diagnosed *intra vitam*. Rarely they may be found in the appendix vermiformis.

Symptoms which lead one to suspect the existence of such lesions are diarrhœal discharges with pus and with or without blood, loss of flesh and strength, hectic temperature, abdominal tenderness, and enlarged peritonæal glands.

The fæcal discharges should be examined for the tubercle bacillus, which if found, when it is certain that it has not been swallowed, establishes the diagnosis. Inability to demonstrate the bacillus is no proof that the lesion is not tuberculous.

Perforation of a tuberculous ulcer rarely takes place; when, however, this event happens general or localized peritonitis with its attendant symptoms results. Healed ulcers cicatrize and may, by their contraction, cause stenosis.

Treatment consists in the employment of the means calculated to relieve the diarrhœa, the pain (see p. 364) and the hæmorrhage (see p. 365). Local treatment of the ulcers is possible when they exist in the rectum, and the lower colon; here irrigations, after the bowel has been cleansed by an enema of warm water, with solutions of copper or zinc sulphate (3 to 1,000), silver nitrate (1–2 to 1,000), silver vitellin (5 percent.), tannic (2–4 to 1,000), or boric acid (1–2 to 100) are useful. Ulcers which can be reached by means of the speculum and applicator should be touched with stick silver nitrate or with strong solutions of the same salt.

Internally the bismuth salts may be given as suggested under the treatment of chronic intestinal catarrh (p. 397).

The administration of a combination of sulphur sublimatum, gr. xx (1.33) and pulvis ipecacuanhæ et opii, gr. v (0.33) every 4 hours has been recommended in tuberculous intestinal ulceration in adults.

The diet should be carefully regulated, consist entirely of non-irritating

foods and should contain as much nourishment as possible. For more specific directions for the feeding of these patients the reader is referred to the section on the diet of chronic catarrhal enteritis (p. 399).

Embolic Ulcer of the Intestine.

This affection is uncommon and, like other forms of intestinal ulceration, very difficult of diagnosis. The ulcers occur in valvular endocarditis, arteriosclerosis, multiple neuritis, pyæmic conditions, and any other state in which lodgment of an embolus in an artery of the intestine is possible. Following the lodgment of the embolus necrosis of tissue and ulceration take place.

Syphilitic Ulcer of the Intestine.

This is a rare condition especially in the small intestine; syphilitic ulcers of the rectum are more frequently seen and are usually situated within a short distance of the anus. They are shallow, of smooth base and may occur as primary, secondary or tertiary lesions; in the last case they result from the breaking down of gummata. In healing they tend to produce strictures though certain recent observers incline to the belief that this latter is a very rare occurrence.

The treatment consists in the administration of mercury and the iodides as described under the section devoted to luetic disease (p. 151), and when the lesions are in proper situation, local applications such as those suggested in the treatment of tuberculous ulceration may be employed.

APPENDICITIS.

Definition. An acute or subacute catarrhal or suppurative inflammation affecting the appendix vermiformis, usually involving the surrounding tissues (typhlitis and peri-typhlitis) and frequently going on to gangrene or perforation of the organ with consequent abscess formation.

Ætiology. While it is probable that this affection occurred as frequently before 1886, the date of the classical paper of Fitz of Boston, as it has done since that time, previous to that year the importance of the disease was not generally recognized.

Appendicitis is a disease of young adult life occurring most frequently between the ages of 15 and 30 years; it is rare in children and after the age of 50. Males are more often affected than females, perhaps because they are more prone to muscular exertion or more probably because in the weaker sex the organ receives an additional blood supply from a branch of the right ovarian artery.

The anatomical formation of the appendix greatly favors its liability to inflammation. It is a blind sac narrower at its orifice than elsewhere, consequently any inflammation of its cavity increases the narrowness of the outlet, thus preventing free drainage and exit of the offending cause of the process and favoring its further development. The shortness of its mesentery is another anatomical factor in the liability of the appendix to infection. This shortness of mesentery is likely to cause a torsion of the organ, which may shut off its blood supply and interfere with its nutrition, since the artery supplying the part is carried in the meso-appendix. Long appendices are particularly subject to torsion because of their proneness to adhere to other tissues.

The presence of foreign bodies—the traditional grape seed, etc.—is much less a factor in the causation of appendicitis than the laity are accustomed to suppose. It is true that foreign substances, especially fæcal concretions, are not infrequently found in diseased appendices, but these must be considered as predisposing causes only. Various intestinal parasites have also been found in this situation.

Errors in diet, exposure to cold, excessive muscular exertion and traumatism are also factors in the production of this inflammation.

The exciting cause of appendicitis is a bacterial infection. Of the micro-organisms to be considered in this connection the most important and the one most frequently responsible is the *bacillus coli communis*. This bacterium is a normal inhabitant of the intestinal tract and as such is harmless—even beneficial—but, confined in an appendix, in some manner it becomes malignant. Not only is this bacillus capable of exciting appendiceal inflammation but others, such as the streptococcus and staphylococcus pyogenes, the pneumococcus, the bacilli of influenza and enteric fever, the bacillus proteus and the infective cause of acute rheumatism, having found ingress to the appendix, are potent in this regard.

Pathology. For purposes of ease in description appendicitis may be separated from a pathological standpoint into four types. *a*. Catarrhal. *b*. Obliterative. *c*. Ulcerative. *d*. Gangrenous.

In the *catarrhal* type the mucous lining of the organ is congested and swollen, there is excessive production of mucus, with which are mixed leucocytes and desquamated epithelial cells, which distends the cavity of the appendix and the free exit of which is prevented by the swelling of the normally narrow opening of the organ. Such an inflammation predisposes to other like attacks and also lessens the resistance of the appendiceal tissues so that they become susceptible to infection by pathogenic micro-organisms.

Obliterative appendicitis is really but a later stage of the preceding type, especially of its severer forms, where the submucosa, as well as the mucosa, is involved. Here there is thickening of the wall of the organ by means of cell infiltration, and a consequent decrease in and at times an obliteration of

the lumen of the tube. Ulcers also may occur which by contraction or by adherence of their surfaces further tend to contract the calibre of the organ. Of this form of the inflammation three courses may be described: First, the organ may be entirely obliterated and converted into fibrous tissue, therewith precluding all possibility of further attacks of appendicitis; secondly, when mucus or purulent fluid is retained in the cavity of the organ behind a stenosis the patient is subject to appendiceal crises; and thirdly, when the inflammation has been marked enough in character to involve the peritonæal coat, adhesions to other structures with consequent inflammation of the same by extension of the infection may be formed.

In the *ulcerative* type of the affection the mucosa and submucosa are necrosed in varying degrees. The presence of foreign bodies or fæcal concretions is especially likely to produce lesions of this form, it is also seen as a result of the two types described above, and it may occur in enteric fever and tuberculosis. The ulceration may result in perforation and general or localized peritonæal inflammation.

In the *gangrenous* type rapid sloughing takes place of either the entire organ or portions of its wall; in either case the condition is a very grave one on account of its liability to occur with little or no warning and even without history of previous attacks of the milder forms of appendiceal inflammation. The process may result in general peritonitis of the severest type or the resisting power of the patient may be such as to permit of the walling off of the sloughing part and the limitation by adhesions of the process to a localized abscess cavity.

The localized peritonæal inflammations occurring with the appendiceal lesions described above vary in degree from a simple peri-appendicular plastic exudate forming adhesions to the adjacent tissues which limit the spread of the infection, to severer forms with a cavity containing purulent exudate and walled off by adhesions from the general peritonæal cavity. Such an abscess cavity usually occupies the right iliac fossa although it may be found in any part of the abdominal cavity—in the pelvis, the lumbar region, under the liver, etc.—owing to unusual situations of the appendix. These abscesses contain from a few drachms to a pint or more of thick or thin, odorless or foul pus. The suppurative process may break its adhesions and discharge into the peritonæal cavity, resulting in general peritonæal infection, or into the intestine, the bladder or vagina. Rupture may also take place outward through the abdominal wall. Metastatic abscesses in the liver may be set up through portal embolism or pylephlebitis.

Symptoms. Mild catarrhal inflammations of the appendix are likely to cause but slight, often hardly noticeable, symptoms; of these pain in the right iliac fossa and slight tenderness are the only ones worthy of mention; indeed the process may proceed to the ulcerative stage without exciting any appre-

hension on the part of the patient. When the inflammation has involved the peritonæum locally the symptoms usually become marked. There is pain, at first general, but after a few hours localized over the seat of the lesion in the right iliac fossa when the appendix is normally situated, but the tendency of this organ to be in anomalous situations may result in localized pain in any part of the abdominal cavity—under the liver, in the left iliac fossa, etc. Change of position increases the pain, as does deep inspiration or coughing.

The tongue is likely to be dry and coated. Vomiting is often present but the vomitus is not characteristic in any way. The bowels are usually constipated this being due to paralysis of the intestinal musculature. At times this symptom is so marked as to suggest obstruction and it may be accompanied by fæcal vomiting. More rarely the bowels are loose.

The temperature is usually elevated, 101°–103° F. (38.5°–39.4° C.), at first, gradually falling as the process goes on to resolution, or assuming the characteristic irregularity if pus is present, although rarely such instances may occur without pyrexia. The pulse is full and rapid—100 to 120. Abdominal distention may be present and is most marked in perforative instances. A leucocytosis of 20,000 to 30,000 is not unusual.

Physical Examination. The patient usually lies on his back with the right thigh flexed on the pelvis, this position offering some relief to the pain. Upon palpation a point of more or less localized tenderness will be found. The classical situation for the point of maximum tenderness is at the middle point of a line drawn from the right anterior superior iliac spine to the umbilicus, although in anomalously situated appendices it will be found over the site of the inflammation. An important diagnostic sign is rigidity of the abdominal muscles of the right side, these structures going on guard immediately when any attempt at palpation is made.

After the tissues have been matted together by plastic adhesions or when abscess formation has taken place a tumor of varying size and consistency may be palpable. Observers with a highly specialized sense of touch may at times be able to feel the enlarged and inflamed appendix.

Over the tumor, when such exists, the percussion note is dull and in the presence of a considerable quantity of pus may be flat. Excessive distention of the intestine by gas gives a note more tympanitic than normal.

The prognosis for recovery in attacks of the simple catarrhal type is good but recurrences are frequent. In the instances with perforation and abscess formation the outlook is much less favorable, especially where surgical intervention is postponed.

Treatment. Probably there is no point in medicine or surgery upon which authorities are so prone to disagreement as upon the proper management of this disease. While early surgical intervention in every instance has its advocates and these of such character as to demand consideration, it is the part of con-

servatism to treat an attack of catarrhal appendicitis by medical means and to consider the advisability after recovery, of the so-called interval operation. Every patient suffering from catarrhal appendicitis should be kept at absolute rest in bed. For the relief of the pain the question of the advisability of the administration of opium is a debatable one. While this drug puts the intestine at rest, thus favoring resolution, as no other drug will, it is insisted by some that its exhibition masks the symptoms indicating the necessity for operative interference. The point against this assertion is that the careful observer will receive sufficient information as to the time for operation from the pulse, temperature, general condition of the patient and the state of the appendiceal tumor. Opium itself, given by mouth or in suppositories, is to be preferred to morphine—the latter, however, may be given hypodermatically when the opium itself for any reason cannot be administered by the other channels mentioned. The tincture of opium may be administered in doses of 10 or 12 minims (0.66–0.8) every hour until 2 or 3 doses have been taken, then 5 minims (0.33) may be given every 3 hours until the pain is relieved. If the pain recurs another such a course of medication may be instituted. The resulting constipation need cause no alarm but should not be allowed to persist longer than a week.

Local applications to the painful area, of the ice coil, ice bag or ice compress are indicated and will be found to greatly relieve the pain and perhaps retard the progress of the inflammation. Warm compresses may be used after the temperature has fallen to normal and the inflammatory process is quiescent. The use of blisters and leeches is unadvisable since, if operation becomes necessary, the resistance to infection of the skin at their points of application is impaired.

Whether or not to administer laxatives is a debatable question. Active purgatives should never be given. There is no doubt that oftentimes attacks of iliac pain, emesis and constipation with what seems to be a tumor in the appendiceal region quickly recover after a free movement of the bowels, but there is reasonable doubt as to whether such are instances of true appendicitis. Early in appendicitis the object is to keep the intestine as nearly in a state of complete rest as possible, consequently here, as well as when perforation is imminent or after suppuration has set in, purgation is contra-indicated. Constipation may be allowed to last 5 or 7 days and, when the chances of perforation are past, the bowels may be moved by carefully given rectal irrigation and should he kept regularly open thereafter.

The elaboration of an antitoxin from the colon bacillus—since this organism is so often concerned in the causation of this disease—has been suggested with the idea in view that patients may be immunized against relapses and against the danger of secondary infection by pus during operation.

The diet during the acuity of the attack should be entirely liquid, milk,

soups, the artificial infant foods, etc., and in quantity should be small; certain clinicians even advocate feeding *per rectum* in preference to that by mouth. Small amounts of water may be taken. When the acuity of the symptoms has subsided semi-solids may be allowed and later, sweetbreads, scraped beef, cereals, etc., may be added.

The indication for surgical intervention is, in the minds of many competent authorities, the establishment of the diagnosis of the disease, but it is certain that many patients recover under careful medical treatment. Concerning such, the question of an interval operation is one to be decided among the patient, his physician and his surgeon. The most conservative clinicians concur that operation is indicated in all instances in which the symptoms do not ameliorate within from 24 to 48 hours, in instances in which an abscess has formed and in early instances of general perforative peritonitis. Advanced instances of diffuse peritonitis which are in a state of practical collapse with rapid and feeble puse, clammy and cold skin are hardly fit subjects for operation. Here stimulation, heat to the extremities, high rectal irrigations of normal saline solution and the other means usually employed in such conditions are indicated. Very rarely does recovery take place.

INTESTINAL OBSTRUCTION.

Definition. A condition in which the normal passage of fæcal matter through the bowel is impeded. This may result from mechanical obstruction or paralysis of the intestinal musculature and may be due to a number of different causes.

Intestinal obstruction occurs in two forms:

a. The acute, which may be caused by congenital anomalies, internal strangulation, volvulus, intussusception, foreign bodies or abnormal intestinal contents and intestinal paralysis.

b. The chronic, which is the result of narrowing of the calibre of the bowel from new growths within this structure, cicatricial contraction, from the outside pressure of tumors of neighboring organs or structures or of the accumulation of impacted fæces.

1. Congenital Anomalies.

These are the result of insufficient or improper fœtal development and may be situated at any part of the digestive tract. The most frequent sites are at the pylorus (see p. 373), in the duodenum, in the ileum and at the anus. Oftentimes there may be stenoses at two or more of these situations.

Symptoms. In instances of imperforate anus there is no passage of meconium and the examining finger will at once perceive the defect. When the obstruc-

tion is at other parts of the digestive tract the symptoms usually do not appear until food has been taken. Here the symptoms are vomiting, at times stercoraceous in character, abdominal pain and ineffectual efforts to pass fæces. At times visible peristaltic action may be detected upon inspection of the abdomen. The prognosis is not good.

Treatment is wholly surgical. An imperforate anus may easily be relieved by means of the knife. A stricture at a higher level offers difficulties since the diagnosis of its situation is well-nigh impossible. Death, however, being certain without operation, this latter should be undertaken, and the stenosis being found, either a resection should be done or an artificial anus formed. Either operation is unsatisfactory for death from inanition is practically sure to supervene.

2. External Strangulation.

This is the most frequent variety of intestinal obstruction and is caused by compression of the bowel by inflammatory adhesions or bands, fœtal remains, such as the omphalo-mesenteric duct, the slipping of a knuckle of the intestine into one of the peritonæal fossæ, through the foramen of Winslow, through the diaphragm, etc. The small intestine is involved in the great majority of instances and the affection is most common in males in early adult life.

Symptoms. Of these the most prominent is sudden, very severe pain which is, as a rule, constant, but may be accentuated at intervals. Persistent vomiting occurs and after 2 or 3 days becomes stercoraceous. The bowels are constipated, but absolute constipation does not come on until the bowel below the obstruction has emptied itself. The intestine above the obstruction distended with flatus (Wahl's sign) and may be demonstrated upon physical examination. The temperature is at first unaffected, later it may rise to 101°–102° F. (38.5°–38.9° C.); the pulse is rapid and weak. In the various forms of acute obstruction a useful diagnostic symptom is the gradual increase in abdominal girth which is due to the augmenting meteorism. This symptom may be demonstrated by taking measurements at intervals.

Treatment. This consists in operation as soon as the diagnosis is made. In instances in which consent to operate is withheld, means for relieving the patient's symptoms should be instituted as described under the treatment of intestinal obstruction in general (p. 422).

3. Volvulus.

This form of intestinal obstruction is due to a twisting of a loop of the intestine about the mesentery as an axis. It occurs most often in men of middle age and is rather infrequent. The small intestine is usually involved

although instances of volvulus of the stomach and of the colon have been re-recorded. The torsion of the gut causing interference with its blood supply, peritonitis and at times necrosis with rupture may result. This type of obstruction is not an infrequent sequela of abdominal operations.

Symptoms. The pain of this form of obstruction is less severe than in any other variety. The constipation, however, is absolute and abdominal distention is a marked feature. The vomiting and other symptoms are similar to those of obstruction due to strangulation.

Treatment other than by operation will be dealt with under the general management of intestinal obstruction (p. 422).

4. Intussusception.

Intestinal intussusception consists in the telescoping of one section of the bowel into another. The invagination consists of the intussuscipiens, the outer layer, and the intussusceptum, the two inner layers. The condition may be simulated for purposes of illustration by slipping one part of a glove finger into another. The condition is named in accordance with the part or parts of the intestine involved, e.g., enteric when the small intestine alone is affected, ileo-cœcal when the ileum and cœcum are invaginated into the colon, etc. Usually the upper part of the gut makes up the intussusceptum but in rare instances reverse intussusception occurs, in which case the opposite condition obtains.

Ætiology. Intussusception is seen most frequently in children under a year old but is not unknown in adult life. As a cause of obstruction it is nearly as common as strangulation. It is predisposed to by diarrhœa and constipation, and while its actual cause is not well understood, it probably results when one portion of the bowel, due to some nervous disturbance, suddenly contracts while a neighboring segment remains relaxed. Intussusception just *ante mortem* frequently takes place and the condition is found on autopsy without having caused symptoms during life.

Pathology. Inflammatory processes arising in the serous surfaces of the bowel brought into contact by the invagination may set up adhesions also permanent attachment between intussusceptum and intussuscipiens. And the invaginated portion may necrose and, the adhesions being of such character as to prevent exit of the intestinal contents into the abdominal cavity, being passed, spontaneous recovery may take place. In other instances the adhesions being insufficient the sloughing may result in rupture with general peritonitis.

Symptoms. The first of these are sudden pain and vomiting. The pain is usually paroxysmal and very severe in character; as a rule it is not distinctly localized although in some patients it may be referred to the umbilical region. It is most severe during the first 2 or 3 days of the attack, later it becomes

less marked. The vomiting is usually persistent and difficult of control, it may be projectile in character but is rarely fæcal in infants, though in older children it may become so. Bloody stools with mucus are a frequent symptom in children and when the intussusception involves the rectum tenesmus is a common manifestation.

The constitutional symptoms are those of marked prostration, with muscular relaxation, pallor, cold extremities and subnormal temperature, which late in the disease may rise as high as 104° F. (40° C.)

Examination shows the presence of a "sausage-shaped" abdominal tumor in the majority of instances, and when the lower colon is involved it may be possible to feel the intussusceptum. It resembles the cervix uteri and may even protrude for an inch or two. There may be a depression in the right iliac fossa (Dance's sign). Measuring the circumference of the abdomen from hour to hour is important in the diagnosis of obstruction; if the abdomen gradually becomes larger is strong probability of its existence.

The affection may terminate by spontaneous reduction or by sloughing of the invaginated gut rupture of the intestine being guarded against by adhesions. Death from shock may take place—in the more acute instances—from peritonitis, or from exhaustion.

Treatment consists in attempts at reduction by means of inflation of the intestine or the injection of fluids. When these measures are ineffectual immediate laparotomy is necessary.

Inflation is practiced by means of a soft rubber catheter to which an ordinary bellows is attached. The air should be forced in very gently and may be prevented from escaping by compressing the nates. The hand should be kept upon the abdomen to determine the degree of tension of the intestine. If reduction follows, rumbling sounds may be detected and the tumor may disappear, but often there is no proof of the success of the treatment; here the air should be permitted to flow out and a thorough manual examination of the abdomen undertaken. Even then the continuance or the remission of the symptoms is the only index of the efficacy of the procedure. Anæsthesia is necessary for the proper carrying out of this mode of treatment unless the abdomen is greatly relaxed.

The injection of fluids is a legitimate method of treatment and is preferred by some to inflation. Either normal saline solution or milk and water at a temperature of from 100° to 105° F. (37.4°–40.5° C.) may be employed. The injection is given from a fountain syringe placed about 5 feet above the patient and through a soft catheter, the exit of the fluid being prevented by compression of the buttocks. Inversion of the patient, if a child, should be practiced at intervals. The fluid should be allowed to flow for about a quarter of an hour, then it may be permitted to escape. Whether reduction has been accomplished may then be determined as after inflation.

The after treatment consists in absolute rest in bed and the administration of moderate doses of opium for several days. No laxatives should be administered during this period and the diet should consist entirely of fluids.

Unfortunately a recurrence of the intussusception not infrequently takes place.

5. Obstruction by Foreign Bodies or Abnormal Intestinal Contents.

The most common cause of this form of obstruction is a biliary calculus; other foreign bodies such as coins, fruit pits, buttons, intestinal parasites, enteroliths, etc., may be mentioned but are much more infrequently causes of intestinal occlusion. This variety of obstruction takes place in most instances in the small intestine, not infrequently at the ileo-cœcal valve.

The symptoms so closely resemble those described under the sections devoted to other types of occlusion as to need no separate discussion.

6. Strictures and New Growths.

Obstructions due to these causes are rare and occur chiefly in adults beyond middle life. They seem to be more common in females than in males and are met usually in the large intestine. Cicatricial strictures follow healed ulcers especially those due to tuberculosis. Syphilitic stricture of the rectum also has been observed.

Annular stricture of the intestine, and particularly of the rectum occurs in intestinal cancer of the colloid type and also in cylindrical-celled epithelioma (see the section on intestinal cancer, p. 432). Various benign neoplasms of the bowel may cause occlusion, and tumors external to the intestine and inflammatory processes of the neighboring structures, by pressing upon the gut, may cause obstruction.

7. Obstruction Due to Fæcal Impaction.

Fæcal obstruction as a result of chronic constipation or paralysis of the intestinal musculature is not infrequent. Its most common site is low in the large intestine and it is seen more often in old persons and in women rather than in men.

Ætiology. This condition is predisposed to by chronic constipation and by chronic intestinal and peritonæal inflammations. It is particularly frequent in the insane and in hysterical and neurasthenic individuals. Its usual site is the large intestine, particularly the cœcum and sigmoid flexure. The mass of fæces gradually accumulating in atonic conditions of the intestine becomes

dry and firm and sets up irritation of the intestinal lining. The intestinal musculature above the impaction may undergo hypertrophy and the internal irritation may spread to the peritonæal coat of the gut, resulting in a local peritonitis.

Symptoms. Of these the most important is an increasing constipation. The abdomen is distended and tympanitic. The breath is foul, the tongue coated and the patient feels weak and languid. Examination reveals a fæcal tumor situated in the cœcal region or other part of the colon with distention in the cœcum or iliac fossa (Bouveret's sign). The mass is more or less firm but may be indented by pressure. If it is in the sigmoid flexure it may consist of a number of separate masses; in the colon proper it is likely to be sausage-shaped and of varying length. Patients of this type with partial occlusion are subject at any time to complete obstruction with its attendant symptoms.

The Treatment of Intestinal Obstruction in General.

The difficulty in the treatment of this condition is to determine when operative interference may be postponed and internal treatment relied upon. In general it may be stated that when there is reason to suspect strangulation, operation should be done at once and that internal measures may be employed only in such patients as give no evidence of abnormal circulatory conditions. Increased pulse frequency and vascular tension are contra-indications to conservative methods of treatment. In other words, instances of obstruction due to foreign bodies and fæcal impaction, when the constitutional condition is unaffected, may receive internal treatment, and patients in whom the obstruction is manifestly due to strangulation or volvulus should be put into the hands of the surgeon at once.

The question as to how long unsuccessful medical treatment may be continued is also important. The answer to this naturally depends upon the same factors as does the decision as to whether or not medical means are justifiable, namely, upon the patient's condition. It may be definitely stated that surgical interference should be delayed not longer than three days at most, and may become indicated after a much shorter period should the heart and circulatory apparatus exhibit symptoms of weakness.

Having decided that internal treatment may be employed remains the decision as to of what this may consist. The means suggested for the medical management of intestinal obstruction have been many and of these the most approved will be discussed.

Drugs. Opium is opposed by many, and especially by surgical authorities on the ground that it induces an apparent improvement and obscures symptoms which, if unaffected by the drug, would indicate operation; consequently opium should be given only in the earliest stages, when the pain is unendurable

and when a probable diagnosis is impossible. Here a hypodermatic injection of $\frac{1}{4}$ to $\frac{1}{3}$ of a grain (0.016–0.022) of morphine sulphate is admissible. Following this a second dose may be given if no relief is experienced.

Atropine recently has been advocated in the treatment of ileus but statistics are insufficient to justify any positive statement as to its efficacy. The principle on which is has been administered is based upon its supposed antispasmodic effect upon the intestinal musculature. It may be given in moderate doses, $\frac{1}{120}$ to $\frac{1}{60}$ of a grain (0.0005–0.001) and hypodermatically three or four times in 24 hours.

Purgatives are distinctly contra-indicated in intestinal obstruction unless an absolutely certain diagnosis of fæcal impaction can be made. In the latter case laxatives may be given; of these perhaps calomel in repeated doses of $\frac{1}{4}$ to $\frac{1}{2}$ a grain (0.016–0.032) is to be preferred. Treatment by high rectal injections of warm water in considerable quantity, retained as long as possible and repeated, frequently if necessary, is also indicated. Low rectal impactions may be removed by the finger or a blunt instrument.

Metallic mercury in large amounts is an old form of treatment but one which is dangerous and consequently should be employed with the utmost caution if at all.

Gastric lavage should be employed in all patients, even in those to be immediately operated upon. In these latter by this means the possibility of vomiting during anæsthesia is greatly lessened. The lavage relieves the distressing vomiting and has been known to relieve the obstruction. One should not be content with one washing but the process should be frequently repeated to disembarrass the stomach of the often rapidly regurgitated intestinal contents. The good effect of this procedure is more marked in obstruction of the small intestine. Rectal enemata are of value in obstruction due to fæcal impaction and intussusception. They may also be employed in other forms of acute occlusion in the hope that the resulting stimulation of peristalsis may cause a reduction of the ileus. Enemata if ice water are a more active peristaltic stimulant than those of warm water but must be given with care especially if there is any tendency to collapse. Irritating solutions have been recommended in invagination, especially solutions of salt (5 to 8 percent.) and good results are reported from their use. Inflation with air (see p. 420) may also be found advantageous.

Massage should be employed only in intussusception and fæcal impaction and here only with the greatest care. It is distinctly contra-indicated when peritonitis is suspected and in patients in whom the obstruction is of long standing, since here there is a possibility of gangrenous conditions which may easily be ruptured.

Electricity—chiefly the faradic current with both poles applied to the abdomen—may prove effectual in stimulating peristalsis in instances of fæcal

accumulation, and is said, at times, to exert a beneficial influence in volvulus. It is, however, a method of treatment of little importance.

The application of cold and warm compresses or poultices to the abdomen may relieve the patient's pain to some extent but is absolutely useless as a method of treatment of the lesion itself.

Diet. In acute intestinal obstruction no food whatever should be allowed. The thirst may be relieved by sucking bits of ice or better by frequently injecting small quantities of brandy and water into the rectum or by enemata of water at body temperature, since when ice is allowed to dissolve in the mouth the patient is continually swallowing water in unknown amount. There is no contra-indication to frequent rinsing of the mouth.

The collapse, if present, may be combated by hypodermatic stimulation.

A description of the technique of the surgical operations adapted to the radical treatment of intestinal obstruction is beyond the scope of a work of this character.

ENTEROPTOSIS.

See section on visceroptosis (p. 380).

CONSTIPATION.

Synonyms. Costiveness; Coprostasis.

Definition. Infrequent or difficult evacuation of the fæces.

The normal human being should have as a rule, one intestinal evacuation every 24 hours. There are, however, individuals, apparently in perfect health, who habitually have a movement of the bowels only every other day, while certain others regularly go to stool twice each day.

Pathology. *Post mortem* examination of the bodies of persons who during life have suffered from habitual constipation reveals no characteristic lesion.

Ætiology. Constipation has manifold causes. Among the factors that are potent in producing the condition are:

a. Insufficient peristaltic action of the intestinal wall. This is a result of atony of the large intestine, which condition is often brought about by suppressing the inclination to go to stool, by chronic intestinal inflammations, the wasting diseases and lack of muscular exercise.

b. Dryness of the intestinal contents resulting from deficiency in the secretion of the intestinal fluids, especially the bile.

c. Weakness of the muscles of the abdomen due to over-stretching of these structures as in conditions of obesity, after pregnancy, etc.

d. Errors in diet. Foods leaving little undigested residue behind, such as milk, concentrated meat soups and jellies, tea and claret, because of their

content of tannin, are prone to cause constipation, especially when little water, which taken in proper quantity moistens the intestinal contents and increases secretion, is drunk. Indigestible foods, irregular meals, and insufficient mastication also increase any tendency to costiveness.

e. Partial stenoses of the bowel caused from within or from without by the pressure of displaced organs, abdominal effusions, peritonæal bands or adhesions interfere with the normal passage of fæcal matter.

Symptoms. These may be indefinite or unrecognizable but in a considerable number of patients the condition results in a variety of manifestations such as a coated tongue, bad breath, lack of appetite, headache, torpor and poor digestion. Uterine and ovarian troubles are accentuated by constipation, and pressure on the veins of the rectum by the masses of hardened fæces often causes hæmorrhoids.

Diarrhœa, especially in the aged, may co-exist, since loose stools caused by irritation from the fæcal masses, may make for themselves a passage through or alongside the impaction.

Treatment. Each patient should be separately studied and the cause of the constipation, if possible, ascertained. This having been done the treatment becomes simplified. When diet and regulation of the patient's habits can be relied upon to relieve the condition drugs should not be employed.

The patient should be advised to go to stool at a certain hour each day no matter if there is no inclination on the part of the bowels to move, for, if the intestine acquires the habit of evacuating itself at a regular time, frequently the mere act of sitting upon the stool will induce a movement. He should also be advised always to heed any inclination to defæcate, at whatever time it may occur.

A regular course of muscular exercise should be prescribed, especially for individuals who are accustomed to a sedentary life. The daily use of light dumb bells or the so-called "setting up" exercises are very efficient; such movements as bending backward and forward from the hips, rotating the body from the hips, rising to a sitting posture with the lower limbs fixed while lying down, etc., are an excellent means of strengthening the abdominal muscles and restoring the tonus of the intestinal muscularis. Bicycling, horseback riding, golf and tennis are to be recommended.

The diet should consist to a great extent of such foods as leave behind a considerable undigested residue, such as fruits of all kinds, eaten with the skins when this is possible, and the green vegetables. Brown or whole wheat bread is preferable to white, and gingerbread may be found useful in children. Honey is laxative as also is molasses. Highly seasoned foods, milk, eggs, pastry and fried foods are constipating. A considerable quantity of water should be taken daily; a glass should be drunk while dressing in the morning and another at night before retiring, with several more during the day. Tea

and red wines should be forbidden. Coffee as well as beer and cider may be allowed.

Medicinal treatment should, as far as possible, be avoided, but it is often found necessary to employ the milder laxative drugs. Of these rhamnus purshiana holds the first place. Its chief advantage is that, less than other drugs of this class, its continued use is likely to necessitate increased dosage, owing to the establishment of a tolerance on the part of the patient; in addition it has a tonic effect upon the intestine. Its great disadvantage is its very unpleasant taste, but this can be obviated by its exhibition in tablet form and by the use of various palatable preparations which may be procured. The dose of the fluidextract is from ½ to 1 drachm (2.0–4.0) or more given at night before retiring. Its employment may be continued for a considerable period the dose being gradually lessened as the tendency to constipation disappears. Aloes or its active principle aloin is another excellent drug of the same class. It may be given in various combinations of which the following example may prove useful. ℞ aloini, oleoresinæ podophylli, extracti belladonnæ, of each gr. ⅛ (0.008); make one pill. This pill taken at bed time usually brings about a natural movement the next morning, and seldom causes griping owing to the belladonna. Hyoscyamus has the same action in this regard and may be substituted.

The list of formulæ for laxative pills might be made almost interminable but it is needless to suggest more than the following: ℞ extracti colocynthidis compositi, gr. i (0.065); extracti rhei, gr. iii (0.20); extracti hyoscyami, gr. ½ (0.033); or ℞ aloini, gr. ¼ (0.004); strychninæ sulphatis, gr. $\frac{1}{60}$ (0.001); extracti belladonnæ, gr. ⅛ (0.008); or ℞ extracti rhamni purshianæ, gr. ii (0.13); oleoresinæ podophylli, gr. ⅛ (0.008); extracti hyoscyami, gr. ½ (0.033).

For patients who cannot, or who think they cannot, swallow a pill the time-honored mixture of rhubarb and soda combined with fluidextract of rhamnus purshiana, 5 minims (0.33) to each teaspoonful (4.0) may be prescribed. A drachm (4.0) of this compound before each meal often gives good results.

Synthetic purgatives such as purgatin and phenolphthalein are useful. The dose of the former is from 15 grains to ½ a drachm (1.0–2.0) and possesses the disadvantage that it may irritate the kidneys. The latter, given in tablet form is willingly taken by children since its taste is pleasant, and is said to bring about no unpleasant after-effects. Its dose is from 1 to 15 grains (0.065–1.0).

When an atonic condition of the bowel is present physostigmine salicylate in dosage of $\frac{1}{100}$ of a grain (0.0006) may be given separately or added to one of the above formulæ.

Compound licorice powder in drachm (4.0) doses is often useful.

The stronger purgatives such as castor oil, calomel and the various salines

are admissible only when the intestine is clogged with fæcal matter that requires immediate removal.

Laxative mineral waters should not be taken habitually as a rule but in obesity, chronic lithæmic conditions and hepatic cirrhosis their occasional use is of advantage. The waters to be recommended are Carlsbad Sprüdel, Hunyadi, Apenta, Villacabras, that of Bedford Springs, Pennsylvania, and Saratoga Congress water.

The treatment of constipation at the various spas is unsatisfactory. During the patient's sojourn at the water cure the regular life, exercise and restricted diet, together with the water drunk, regulate the bowels but on returning home the cure is found to be by no means permanent.

The continued treatment of constipation by enemata is not to be recommended. An injection is, however, a most approved means of removing fæcal impactions and managing the attacks of obstinate constipation that at times occur in the course of chronic states of costiveness.

The injection may consist of lukewarm water or of soap suds. If these are ineffectual, the condition can probably be relieved by an enema of 8 ounces (250.0) of olive or cotton seed oil, 2 ounces (60.0) of castor oil, turpentine spirit, ½ ounce (15.0) to the pint (500.0) of warm water or, if the impaction is particularly obstinate, a mixture of 1 drachm (4.0) of ox gall in a pint (500.0) of water.

Rectal enemata should be given from a fountain syringe suspended 4 or 5 feet above the patient and through a soft rubber rectal tube passed high into the rectum. The Davidson syringe if employed should be used with great care, especially in children for if too great force is exerted there is danger of intestinal rupture.

Impactions low in the rectum may be relieved by means of suppositories of glycerin or such as the following: ℞ glycerini, ♏iii (0.2); pulveris aloes, gr. ⅓ (0.022); extracti belladonnæ, gr. ¼ (0.016); olei theobromatis, q.s. ad, gr. xv (1.0).

Massage of the abdomen is an excellent adjunct to treatment and may be performed either by a nurse or the patient himself. The manipulation should be commenced in the region of the splenic flexure of the colon and carried on along the descending colon toward the rectum; then beginning at the hepatic flexure the endeavor should be made to unload the transverse colon; finally the cœcum and ascending colon are *masséed* and the *séance* is ended by traversing the whole colon from ileo-cœcal valve to sigmoid flexure. The patient also may be instructed to percuss his abdomen with the ulnar border of the hand along the course of the large intestine for a number of minutes night and morning. A vigorous course of treatment of this character may succeed where drugs have failed. Rolling a 5 lb. (2265.0) shot upon the abdomen for 5 or 10 minutes every morning has been recommended.

Hydrotherapeutic measures such as vigorous friction baths, cold or alternate warm and cold spinal douches, hip baths at 50° to 68° F. (10° to 20° C.) of from 2 to 5 minutes duration once or twice a day and a wet abdominal compress at 50° F. (10° C.) on retiring are approved additions to general hygienic treatment.

Electricity in the form of the faradic current may be employed with the object of causing short colonic contractions. One electrode may be applied to the back while the other is pressed deep into the abdomen. The abdominal electrode should not be held stationary for any length of time, but its situation should be rapidly changed. Static electricity in the form of the wave, or the static induced current, is useful, the former in mild constipation, the latter in obstinate chronic instances. When the static wave-current is used but one pole is in contact with the patient, the other being grounded or not; if the latter, the treatment is milder than when the former is the case. The current is transmitted to the patient either through a rectal electrode or a flat electrode applied to the wall of the abdomen, its strength being regulated by the spark-gap between the sliding poles.

In using the static induced current the patient is connected with the outer surface of the Leyden jars, their inner surfaces being connected with the poles of the machine. One electrode is placed upon the back, the other in the rectum, or both are applied to the back.

The treatment of constipation in infants is dietetic when it is possible to combat the condition by this means. Fortunately in breast-fed babies the condition is rare. In bottle-fed children the regulation of the proper proportion of fat and proteid will overcome the difficulty. Very often raising the fat percentage or reducing that of proteid is all that is necessary. If the constipation is obstinate the use of an occasional teaspoonful of olive oil in conjunction with abdominal massage and, if necessary, the employment now and then of a suppository constructed of a cone of oiled paper may prove successful. Suppositories of soap or glycerin are irritating to the rectum but those of gluten do not possess this disadvantage and may at times be used with benefit. If laxative medicines are necessary young infants may be given a few grains of sodium phosphate or a teaspoonful or two of milk of magnesia may be added to the last bottle at night.

The management of constipation in older children should be carried out along the same lines as those suggested in its treatment in adults; the establishment in early life of a regular habit of going to stool is most important.

COLITIS.

Most of the Diseases of the Colon are caused by infections. Reference should be made to the section upon Infectious Diseases.

DILATATION OF THE COLON.

This condition occurs in both an acute and a chronic form; the first as a result of acute obstruction, the second as a sequel of chronic constipation or atony of the bowel. Colonic dilatation is also observed as a congenital defect. Here it usually affects the descending portion or the sigmoid flexure and is a factor in the production of constipation later in life.

Pathology. Any part of the colon or its whole length may be dilated. In chronic instances the muscular coat may be thickened, in acute instances the whole intestinal wall may be thin as a result of stretching or atrophy.

Symptoms. There is obstinate constipation, marked abdominal distention and often pressure upward upon the liver, spleen, and thoracic viscera. In severe instances the action of the heart and lungs may be greatly embarrassed, sudden death even having occurred as a result of interference with the heart. In more acute instances vomiting may be present. Examination reveals an abdomen greatly distended and markedly tympanitic, hepatic and splenic dulness often being obscured.

Treatment consists in relieving the constipation by high enemata, in obstinate instances, of oil or ox gall (see p. 427) if necessary. These should be given in connection with drug medication given by mouth with a view to overcoming the obstructive condition from above. Having emptied the bowel, remains to bring about as normal an intestinal action as possible. This may be accomplished by the administration of laxatives, castor oil now and then being very effectual, the prevention of distention by means of antifermentives such as bismuth tetraiodophenolphthaleinate, gr. v (0.33) with resorcinol, gr. ii (0.13), beta-naphthol, gr. xv (1.0) or bismuth naphtholate, gr. x (0.66).

The administration of physostigmine salicylate—gr. $\frac{1}{100}$ (0.0006) or of strychnine sulphate—gr. $\frac{1}{30}$ (0.002) is useful in restoring the normal tonicity of the bowel.

One should always make a digital exploration of the rectum, for manual removal of fæcal impaction is often necessary.

The diet should be easily digestible, such as to cause as little fermentation as possible and composed of foods—meat in particular—that leave little residue behind.

Surgical procedures such as the formation of an artificial anus or resection of considerable portions of the bowel, when indicated, have given good results.

NERVOUS AFFECTIONS OF THE INTESTINES.

Of these we may distinguish three types:

a. Motor disorders.

b. Sensory disorders.

c. Secretory disorders.

Of *motor disorders* there are three classes:

1. Increased peristaltic activity of both small and large intestine resulting in the so-called nervous diarrhœa; there is also probably an increased intestinal secretion as well. The condition is seen most often in neurotic and hysterical patients and after unusual mental shocks, such as may be caused by sudden fright, joy, etc. There is no pathological change in the intestine; the attacks of diarrhœa appear without warning and may cease suddenly. The stools vary in frequency from 2 to 15 or 20 during the day and are composed of thin watery matter, mucus being seldom present and blood still more rarely. During the defæcation there may be a considerable expulsion of gas, tenesmus and intestinal rumblings.

2. Peristaltic unrest or tormina intestinorum chiefly involves the small intestine and consists of peristaltic waves passing from one end of the bowel to the other and carrying with them whatever of gas or fluid may be present. The condition occurs both in neurotic and in perfectly healthy subjects and concerning its cause we can but advance the theory that it is the result of a hyper-excitability or an increased activity on the part of the nervous mechanism which presides over peristalsis.

The excessive peristalsis may follow emotional shocks, occur at the menstrual epoch or without assignable cause. An attack usually lasts but a few minutes but may be prolonged for hours. It is evidenced by very perceptible rumbling and gurgling sounds in the abdomen, varying in intensity. Pain is rare but the patient is usually distressed because of the embarrassing amount of attention attracted by the affection.

3. Nervous cramp or enterospasm is an obscure affection consisting of a contraction of the intestine limited to a small portion of the bowel or involving a considerable length of this structure. The spasm is characterized by pain lasting for variable periods; there may be localized distention of the bowel.

4. Intestinal paralysis apparently results from over-irritation of the inhibitory nerves of the intestinal muscularis which may finally undergo atrophy. The condition, when chronic, produces habitual constipation.

The treatment of the increased peristaltic activity consists in the employment of means calculated to combat the nervous and hysteric states from which the condition results. Constipating drugs have no effect. Success may attend the use of the bromides and arsenic together with the regulation of the mode of life and attention to general hygiene.

Of the treatment of peristaltic unrest the same can be said as regards general management; spa or institutional treatment, with electricity and hydrotherapeutic procedures as adjuncts, often achieves good results. With regard to drugs, arsenic, the bromides, valerian, codeine and belladonna have been

recommended, with hydrated chloral and opium as last resorts. These last two must be used with great care lest the patient become a drug habitué.

In enterospasm all methods of treatment which increase intestinal irritability, such as electricity, massage, cold applications and the like, must be avoided. Marked constipation occurring with this condition should be relieved by oil injections, and the local application of warm compresses and the employment of warm baths are approved methods of treatment. The administration of various drugs has been suggested with the view to lessening the irritability of the intestine; of these opium, belladonna, acetphenetidine (phenacetine) and antipyrine may be mentioned.

Intestinal paralysis should be treated by the administration of strychnine sulphate in considerable doses—gr. $\frac{1}{30}$ to $\frac{1}{20}$ (0.002–0.003)—3 times a day and by other measures calculated to stimulate and restore the tone of the intestinal musculature, such as massage and electricity.

Sensory disorders. Intestinal neuralgia is a painful affection resulting from a hyper-sensitiveness of the sensory nervous mechanism of the bowel. The condition is distinct from the pain of true colic and is seen in nervous and hysterical individuals, certain nervous diseases, especially locomotor ataxia (tabetic intestinal crises), in gouty conditions and as a result of chronic plumbism. The pain is general, involves the whole abdomen, and is of extremely severe type. It is increased on pressure. Its diagnosis is very difficult, there being so many painful abdominal affections from which it must be differentiated that at times an exploratory laparotomy is the only means by which the condition can be certainly diagnosticated.

Intestinal hyperæsthesia or abnormal sensations in the bowel occur in hysterical and neurasthenic patients. Of these there is a great variety ranging from feelings of fullness, tickling or throbbing to severe burning or stabbing pain. The condition is the result of some disorder of the central nervous system or of a local derangement of the intestinal innervation.

The treatment of both these conditions resolves itself into the proper management of any neurotic tendency which may exist, by means of general measures such as the rest cure, institutional or spa treatment. Belladonna may afford relief; opium should never be given on account of the danger of habit formation. Sensory disorders due to tabes, gout or plumbism should receive the treatment which their causes indicate.

Secretory disorders are the result of vaso-motor derangements and are very difficult to separate from abnormalities of motility and sensation, in fact these conditions often occur simultaneously. Certain influences, however, may cause excessive outpouring into the bowel of large quantities of serous or mucous fluid. The management of such conditions has been discussed under the sections on the treatment of nervous diarrhœa.

MALIGNANT GROWTHS OF THE INTESTINE.

Carcinomata may occur in any part of the bowel. They involve, in by far the majority of instances, the rectum, are much less common in the colon and are very rare in the small intestine. Various types of cancer have been observed; those most frequently seen in the small intestine are cylindrical celled epitheliomata or adeno-carcinomata and the most usual site of the neoplasm is in the duodenum near the opening of the bile-duct. In the colon we find cylindrical celled epitheliomata; the situations most frequently involved are the caput coli and the sigmoid flexure. In the rectum malignant new growths are of more varied type, colloid, scirrhus and soft carcinomata as well as epitheliomata of the squamous celled type commonly existing in this situation; sarcomata are much more rare but do, at times, occur.

Symptoms. These are by no means typical. The usual cancerous cachexia is usually present, if not at first, in the later stages. To this may be added the symptoms of partial obstruction such as pain, nausea, vomiting and constipation, with the presence of a tumor. This last varies in size and situation, is usually firm in consistency, irregular of surface and generally tender. It is frequently movable, but this is not always the case. It is dull on percussion and may seem to pulsate if it is situated over the aorta. Masses of fæcal matter lying above it in the bowel may obscure the tumor but the administration of irrigations or laxatives will remove these, after which the true character of the lesion will become apparent.

In cancer low in the rectum digital examination or inspection by means of the proctoscope will reveal the presence of a malignant obstruction.

The bowel movements are constipated in character as a rule but may be otherwise normal in rare instances. If the neoplasm is in the rectum they are likely to be ribbon- or pencil-shaped as a result of the stenosis. They may contain blood and more or less fœtid pus, the former both before and after ulceration has taken place, the latter after this event only. The presence of mucus signifies little else than that an inflammatory condition of the intestinal lining is present; the occurrence, however, of sanious pus or muco-pus is of extreme importance from a diagnostic point of view since these appear only in intestinal cancer, in ulcerative colitis and as a result of the rupture of an abscess into the lumen of the bowel. The large amount of the pus in the last case and the unlikelihood of colitis being mistaken for malignant intestinal tumor simplify the differential diagnosis of cancerous conditions. The importance of digital rectal examination, however, in all suspicious instances cannot be over-estimated.

The separation of duodenal cancer from pyloric carcinoma is difficult, the presence of jaundice, lack of early dyspeptic symptoms and normal acidity

of the gastric contents pointing to, but not rendering certain, the existence of the former condition.

Non-malignant tumors of the intestine, such as *polyps*, *fibromata*, *angiomata*, etc., may exist without causing symptoms; they may, on the other hand, produce symptoms resembling those of malignant growths, such as stools containing mucus and blood; there is no resulting cachexia and the neoplasm may be seen or felt upon rectal examination.

The treatment of cancers of the bowel consists in removal of the growth by surgical procedure when this is possible. The operation indicated varies with the condition present. Resection of the bowel without the formation of an artificial anus has prolonged life and excellent results may be achieved in favorable instances by rectal resection.

When surgical intervention is for any reason decided against, the patient's general condition should receive attention. His nourishment should be maintained by the administration of easily digested foods given by the mouth or *per rectum*, and stimulants should be prescribed when necessary. The possibility of obstruction by fæcal matter should be provided against by regulation of the bowels so that a sufficient movement is obtained each day.

PROCTITIS.

Proctitis or inflammation of the mucous lining of the rectum occurs in various types, usually as a part of co-existing colonic inflammation. For a description of these conditions and their treatment the reader is referred to the sections upon dysentery, entero-colitis and intestinal ulceration.

HÆMORRHOIDS

Synonym. Piles.

Definition. Hæmorrhoids is the term employed to designate a varicose condition of the veins of the lower rectum. Their most frequent situation is at the muco-cutaneous junction at the anal orifice.

Hæmorrhoids are internal or external depending upon whether they are developed within the sphincter ani or outside this muscle.

Pathology. The hæmorrhoidal tumor is composed of dilated blood-vessels, of clots beneath the mucous membrane or of the muco-cutaneous integument of the anal region. It is seldom single; more frequently there are two or more. In shape they are spherical or ovoid, of the size of a small pea to that of a good sized grape or even larger; in color they are reddish or purple, their surface is smooth or lobulated, and in consistency they vary from soft and fluctuating to firm and tense. On section they are found to be filled with venous blood and if of long standing the cavity of the tumor may be intersected with a reticular growth of connective tissue.

Ætiology. Hæmorrhoids are predisposed to by the erect posture of the body and the anatomical arrangement of the structures involved; the fact that hæmorrhoidal veins drain into both the general and the portal venous circulation renders the occurrence of piles common in conditions involving venous obstruction, such as cardiac lesions, hepatic cirrhosis, etc. Hæmorrhoids are common in both men and women; the former seem to be more frequently affected than the latter, although this may be the result of the natural disinclination of the female sex to consult a physician concerning such a condition.

Chronic constipation is a common predisposing cause of hæmorrhoids, the hard fæcal masses pressing upon the veins of the rectum and rendering free circulation difficult. Pelvic tumors, uterine displacements, etc., act in the same manner and have the same result; hæmorrhoids are a common and often very distressing complication of pregnancy. The tendency of the menstrual flow to relieve congestion of the pelvic region is likely, on the other hand, to militate against the production of piles.

Hæmorrhoids are also predisposed to by the wearing of over-tight clothing about the waist, by over-eating and drinking and by sedentary habits.

Symptoms. Piles may exist for long periods without causing symptoms. Should an external hæmorrhoid become congested for any reason the first symptom is pain in the region of the anus, accompanied by sensations of tingling; these increase until sitting becomes impossible and a movement from the bowels is attended with excruciating agony. Examination reveals one or more purplish tumors at the anal margin, hard and tense and excessively tender. The tumor may gradually disappear and the symptoms abate, abscess formation may ensue and spontaneous cure result after rupture and discharge of the pus, or the circulation being cut off by the engorgement, the hæmorrhoid may ulcerate off. At any time inflammation may recur with its attendant symptoms. Recurrent hæmorrhage from the tumors is not infrequent and is not harmful provided not too much blood is lost.

Internal piles may be single or multiple. The symptoms produced by them are a feeling of fulness or tenesmus in the rectum, with dull aching pain and perhaps a mucous rectal discharge. Engorgement with symptoms corresponding to those of external piles may at any time appear and hæmorrhage is not uncommon; this latter may relieve the discomfort but at times so much blood is lost as to jeopardize the health of the patient.

Treatment consists in attention to any causative factor in the shape of cardiac, hepatic or pelvic disease, the securing of a normal movement of the bowel each day (see the treatment of constipation, p. 425) and careful daily cleansing of the parts by means of soap and warm water. Painful hæmorrhoids when not acutely engorged may be relieved by various astringents such as liquor ferri subsulphatis; this should be applied 2 or 3 times daily with a brush. Ointments such as the following are often effectual: ℞ unguenti

stramonii, unguenti belladonnæ, āā. ℥ii (8.0); unguenti gallæ, ℥iv (15.0); or ℞ extracti suprarenalis, ℥ii (8.0); adipis lanæ hydrosi, ℥vi (24.0). These ointments should be applied generously to the affected part, a wad of cotton should be fitted over the anus and held in place with a T-bandage.

Inflamed and engorged piles may be relieved by holding a piece of ice in contact with the tumors, by spraying them with a jet of cold water or by applying a compress of gauze impregnated with boroglyceride or by ointments such as the following: ℞ morphinæ sulphatis, gr. x (0.66); unguenti belladonnæ, unguenti stramonii, āā ℥iss (6.0); ichthyolis, ℥v (20.0); or ℞ morphinæ sulphatis, gr. iss (0.1); acidi tannici, ℥ss (2.0); picis liquidæ, ℥ss (2.0); cerati, ℥ss (2.0); adipis benzoinati, q.s. ad ℥i (30.0).

The treatment of piles which are not protruded is practically identical with that already given. The difficulty of applying ointments to the tumors within the sphincter may be obviated by the use of the "pile pipe," an instrument adapted to the injection of semi-solid materials, and the employment of suppositories; of these the following excellent examples are worthy of trial: ℞ ichthyolis, acidi tannici, āā gr. v (0.33); extracti belladonnæ, gr. ½ (0.032); extracti hamamelidis, olei theobromatis, q.s. ad gr. xv (1.0). Fiat suppositoria; ℞ iodoformi, gr. v (0.33); olei theobromatis, gr. x (0.66). Fiat suppositoria.

Hæmorrhage from protruded piles may be controlled by the application of a wad of cotton thoroughly impregnated with iodoform, powdered supra-renal extract, powdered calomel, bismuth subgallate or aristol, or a compress saturated with a 10 percent. solution of calcium chloride; bleeding from the non-protruded variety may be stopped by the injection of 5 drachms (20.0) of 10 percent. calcium chloride solution or the introduction of suppositories such as the following: ℞ extracti suprarenalis, gr. v (0.33); olei theobromatis, gr. x (0.66).

For a description of the treatment of hæmorrhoids by injection and radical surgical measures, which are indicated when medicinal treatment fails, the reader is referred to works upon rectal diseases or upon surgery.

DISEASES OF THE LIVER.

ABNORMALITIES IN SHAPE AND POSITION OF THE LIVER.

The most common and important abnormality in the shape of the liver is the result of the constriction of tight waist bands or corsets, the so-called "corset" or "lacing liver." The deformity consists of a division of the right lobe into two parts by a transverse groove of varying depth. At times the furrow is so deep that the right lobe is divided into two more or less equal portions by a tendinous band. The symptoms which ensue are usually unimpor-

tant the chief interest of the condition lying in the fact that the lower division of the lobe, which often reaches to the umbilicus and may extend as low as the iliac crest, is likely to be mistaken for an abdominal tumor or a misplaced kidney; its margin, however, in most instances, is continuous with that of the left lobe of the liver and the displaced organ descends with inspiration. If the intestine lies in the groove and is tympanitic upon percussion there is an added difficulty in the differentiation of the condition. The symptoms, if any, are those incident to the dragging down of the tumor, and nervous manifestations, such as those caused by a movable kidney, may be present.

At times the corset liver lies almost entirely above the costal margin, it is narrower above than below and the transverse furrow is just superior to the lower margin of the organ.

These deformities of the liver are said to offer an obstruction to the normal flow of the bile and consequently to predispose to the formation of hepatic calculi.

Abnormalities of Position. The liver may be upon the left side of the abdomen in instances of visceral transposition. Not uncommonly is the organ tilted forward so that, although there is no increase in size, the lower border may be palpable below the costal margin. This tilting may be so extreme that the vertical diameter of the organ may become horizontal. The liver may also be displaced upward by the pressure of abdominal growths or by peritonæal effusions and downward by fluid in the right pleural cavity or by the expanded lung of emphysema.

The movable liver is a rather rare condition, which may be caused by tight-lacing and also may occur as a part of a general visceroptosis. The displacement of the organ may be slight only or so considerable that the entire liver may fall below the edge of the ribs in which case the coronary and suspensory ligaments are so elongated as to form a mesohepar.

Physical examination in instances of marked hepatoptosis reveals an absence of the normal liver dulness and the existence of a tumor having the size and shape of the liver in the abdominal cavity below the normal position of the organ. The tumor is usually freely movable and may be replaced if the patient assumes the recumbent position.

The symptoms usually observed are analogous to those of movable kidney, namely a dragging sensation in the abdomen together with the nervous manifestations which so often are associated with nephroptosis. In a considerable proportion of instances jaundice with pains resembling those of hepatic colic occurs.

Treatment consists of the application of a properly fitting belt or bandage calculated to hold the organ in place. When the hepatoptosis is a part of a general ptosis of the abdominal viscera the treatment is that of the visceroptosis (see p. 380).

PERIHEPATITIS.

Synonym. Capsular Cirrhosis.

Definition. A localized peritonitis involving that portion of the membrane which surrounds the liver.

Ætiology. Perihepatitis is observed as a result of extension of some hepatic inflammation such as abscess; in association with a general peritonitis; as an extension of a pleuritic inflammation through the diaphragm; as a result of traumatism; as a result of perforation of the stomach, intestine or gall-bladder or as a part of a general inflammation (*panserositis*) of the serous membranes including the pleura, pericardium and peritonæum. It has also been considered as due to an arterial nephritis.

Pathology. Fibrinous perihepatitis is characterized by the exudation of fibrin upon and the formation of adhesions of the peritonæal covering of the liver. These adhesions may, in the purulent type of the inflammation, encapsulate collections of pus between the liver and the diaphragm (*subdiaphragmatic abscesses*) which may ultimately perforate upward into the pleural cavity.

In the chronic form the inflammation consists of a marked thickening of the entire capsule of the liver with consequent contraction and diminution in the size of the organ which, however, is itself seldom the seat of a cirrhosis. The thickening is often extreme at the hilum of the liver and there may be stenosis of the blood-vessels and bile ducts at this point; adhesions to surrounding structures are very common.

Symptoms. These are often not in the least characteristic and frequently the condition is unsuspected during life; pain over the hepatic region may be present. In some instances the symptoms are those of atrophic cirrhosis with recurrent ascites but no jaundice. Physical examination may reveal the presence of a friction sound over the liver or over the epigastric region when there is marked general capsular thickening. When there is a purulent exudate between the diaphragm and the liver there is also a septic temperature with chills and sweating; the lower ribs of the right side may be forced outward and the physical signs of pleuritic effusion may be present with flatness and absence of voice, breathing and vocal fremitus even as high as the angle of the scapula. Rupture of the pus cavities may take place upward into the pleura into the abdominal viscera or outward through the skin.

The diagnosis between suppurative perihepatitis and pleuritic effusion is sometimes difficult but the early symptoms of the former are abdominal rather than thoracic. The liver is displaced further downward in the former condition. Aspiration may be of assistance in differentiation and it has been stated that the pressure of the out-flowing fluid is increased during the

descent of the diaphragm with inspiration in subphrenic abscess while in effusion into the pleura the opposite is the case.

The non-purulent perihepatitis with localized thickening is seldom recognized during life.

The prognosis in the suppurative type is unfavorable; the localized thickenings of the hepatic peritonæum are not prejudicial to life but the generalized perihepatitis with associated thickening of the other serous membranes is a serious and ultimately fatal condition.

Treatment. In the more acute instances of perihepatitis before pus-formation the patient should be kept in bed on a light diet. The pain may be relieved by counter-irritation in the form of hot compresses, mild mustard poultices, cupping or leeching. The application of straps of adhesive plaster will lessen the movement and prevent stretching of the adhesions but has the disadvantage that the interference with motion tends to permanency of the adhesions.

When pus is present surgical measures should be immediately undertaken with its evacuation in view.

In the general thickening of panserositis with ascites the treatment is identical with that of hepatic cirrhosis with peritonæal exudate (see p. 445). The intake of fluids should be limited, depletion by purgatives and diuresis may be given a trial. Inunctions of 10 percent. iodine in vasogen may be prescribed in the hope of causing absorption of the peritonæal proliferations. Large accumulations of ascitic fluid necessitate paracentesis. Repeated tappings are sometimes indicated. The treatment of ascites by means of operation will be discussed in the section upon the treatment of hepatic cirrhosis.

ABSCESS OF THE LIVER.

Synonym. Suppurative Hepatitis.

Ætiology. Hepatic abscess is in all probability, in every instance, the result of microbic infection. The possibility of chemical insult to the organ, however, may be considered.

Infection of the liver tissue and subsequent abscess formation may result from a number of causes; of these the most frequent are:

1. Infection with the amœba coli. In most instances of this form of the affection there is a preceding tropical amœbic dysentery but amœbic abscess of the liver has been observed in the absence of symptoms referable to the intestine. Amœbic abscesses are usually single, of considerable size and as is natural, most common in tropical countries.

2. Pyæmic abscesses occur as a result of the lodgment in the blood-vessels of the liver of septic emboli. These are often multiple and usually of small

extent. They occur in pyæmia, osteomyelitis, malignant endocarditis, ulcerative inflammations of the intestines, pelvic suppuration, peritonæal inflammations, etc.; when the primary suppurative process is in the area of the systemic circulation the infection is brought to the liver by the arterial system as a rule; more rarely it may be transmitted by means of the inferior cava and the hepatic vein.

3. Foreign bodies, such as hepatic calculi or parasites may set up an infective cholangitis which may proceed to abscess formation.

4. Tuberculous hepatitis may be characterized by the development of multiple abscesses.

5. The passage of foreign bodies from the œsophagus, stomach or duodenum into the liver itself, where an abscess may result, or into one of the portal vessels, where an infective pylephlebitis followed by an abscess may take place, is a rare cause of hepatic suppuration. Hydatid cysts of the liver are subject to infection and subsequent abscess formation.

6. Traumatism over the liver is a recognized cause of hepatic abscess and head injuries may be followed by the occurrence of this lesion.

Pathology. Abscess of the liver may be single or multiple. Large abscesses are most frequently situated in the thickest part of the right lobe, the cavity being sometimes so large as to involve the whole of this structure. The liver may be enlarged and, if the abscess is near the surface, a fluctuating swelling may be noted. The lining of the larger abscess cavities is usually ragged and their contents may be thin and fœtid or thick and viscid; it is often bile-stained. It often contains cholesterin and bilirubin crystals. The pus of the amœbic abscesses usually contains the amœba coli. The pus of echinococcus abscesses contains the characteristic hooklets.

Pyæmic abscesses are usually small and multiple but they do not often communicate. They begin as a phlebitis which spreads to the adjacent tissues. The liver is enlarged but its external appearance may be unchanged; if the abscesses are near the surface there may be capsular inflammation and adhesions to neighboring structures. Superficial abscesses may be evidenced by the occurrence of yellowish spots upon the surface of the organ. In marked instances of suppurative pylephlebitis the liver on section exhibits a number of small yellowish areas, rounded or branching, from which pus exudes on pressure. Careful examination will reveal the fact that these small abscesses communicate with the portal vein and are really branches of this vessel in a state of suppuration. Involvement of the entire portal system may be observed and the infective process may extend into the mesenteric or gastric veins.

In the multiple abscesses of cholangitis the appearance of the liver is similar to that just described but the pus is in the bile ducts instead of in the branches of the portal vein. Gall-stones and suppurative cholecystitis are often present.

Perforation of large abscesses into the pleura, lung or any of the adjacent

viscera, into the peritonæal cavity or through the skin externally may take place.

Symptoms. These may be very indefinite; in rare instances death from rupture and general peritonitis may occur before there is suspicion of the true nature of the affection.

Elevation of temperature is quite constant, the curve being of the pyæmic type and reaching as high, in some instances, as 105° F. (40.5° C.). The fever is accompanied by irregular chills and sweating, the latter often being marked during sleep. Fever may be slight or absent in chronic instances of the affection. Jaundice in varying degrees may be present but is a rather inconstant symptom. There is pain in the region of the liver or it may be referred to the shoulder or back. The patient is often more comfortable when lying on the right side. There is tenderness upon pressure over the liver especially at the margin of the ribs anteriorly. There may be a co-existent diarrhœa, especially in amœbic abscess, and the presence of the amœbæ in the fæces is a great aid in diagnosticating the condition.

Perforation into any of the surrounding structures or through the skin may take place. Rupture into the lung is characterized by convulsive cough with the expectoration of sputum of reddish brown tint resembling anchovy sauce, and the signs of consolidation at the base of the right lung. The sputum may contain the amœba coli.

Physical examination reveals an increase in the size of the liver, usually of the right lobe, which is enlarged upward rather than downward. This enlargement is evidenced by an extension of the normal liver dulness upward; this is especially marked in the mammillary and mid-axillary lines. Large superficial abscesses may cause a bulging of the overlying surface and it may even be possible to detect fluctuation. Adhesions to the abdominal wall may take place and as a result of these fremitus may be elicited. The compressed lung moves less upon respiration than normally. In some instances of extreme hepatic enlargement the margin of the organ may be palpable below the costal margin; its surface is smooth and tenderness is often present.

The symptoms of the multiple pyæmic or pylephlebitic abscesses occur as part of those of a general pus infection. The pyæmic temperature, with its accompanying sweats and chills, is present and the skin may be jaundiced. There is pain in the hepatic region with tenderness on pressure and the liver is the seat of a uniform increase in size.

The diagnosis. Hepatic abscess may be confounded for a time with malarial fever but the absence of plasmodia from the blood and the inefficacy of quinine are sufficient to exclude the latter. When upward perforation has taken place and the previous symptoms have not been characteristic the condition may be considered to be an empyæma or pulmonary abscess but

the presence of the anchovy sauce sputum and of amœbæ renders the diagnosis simple.

Infected echinococcus cyst may be diagnosticated as abscess but its character is hardly recognizable unless hooklets are found in the aspirated pus. The employment of the exploring needle is to be advised in suspected abscess of all varieties but a failure to withdraw pus does not exclude the possibility of its presence. The needle should be of moderate calibre and the operation should be performed under general anæsthesia. The usual points of puncture are over the point of maximum dulness, in the seventh interspace in the anterior axillary line or in the seventh space in the mid-axillary line.

Hepatic intermittent fever due to the presence of calculi is associated with a history of biliary colic and the presence of more extreme icterus; in other respects, such as in its temperature curve, chills, sweating and liver tenderness, it may resemble the more serious condition of abscess.

Leucocytosis is usually marked in abscesses of the liver of the pyæmic variety; it is likely to be absent in those due to the presence of the amœba coli.

The prognosis, since early operation has become the preferred mode of treatment, seems to be more favorable than previously. In any case, however, the condition is a very serious one and the probability of a fatal outcome is great.

Treatment. If the patient is seen early he should be kept in bed upon a fluid diet and an ice bag should be applied over the liver; cupping is advised and the application of a number of leeches to the hepatic region and about the anus, in order to relieve the congestion of the portal system, may be employed. The bowels should be kept freely open by the administration of mild laxatives and ammonium chloride in 20 grain (1.33) doses 3 times daily may be given empirically. In the future we may be able to treat the condition by means of the hypodermatic injection of a bactericidal serum, examination of the patient's blood revealing the character of the causative micro-organism and the type of serum indicated.

As soon as the presence of an abscess is determined surgical measures should be undertaken. These consist of various procedures such as aspiration, which is most likely to be successful in tropical abscesses; puncture with drainage, a large canula being employed and left *in situ*—later it may be replaced by a drainage tube of rubber; and free opening with the knife. The interior of the cavity should be thoroughly investigated and neighboring abscesses, if present, also evacuated. After incision free drainage should be provided. Rupture into the peritonæum, pleura, lung, pelvis of the kidney or pericardium necessitates immediate surgical interference. In rupture into the intestine without peritonæal involvement, operation need not be undertaken unless the contents of the gut enters the abscess cavity and pro-

duces a gangrenous process; here external opening and drainage are indicated.

During convalescence the patient should seek a change of climate, either at the seashore or the mountains, and tonics with abundant nourishing food should be prescribed.

Multiple pyæmic and pylephlebitic abscesses are fatal, usually without exception, and unless signs of localization become evident, radical measures are hardly advisable, the treatment being that of ordinary pyæmia.

CIRRHOSIS OF THE LIVER.

Synonyms. Interstitial Hepatitis; Gin-drinker's Liver; Hob-nail Liver; Sclerosis of the Liver.

Definition. A chronic inflammation of the connective tissue framework of the liver resulting first in an hypertrophy of the organ and later, because of the tendency of the newly produced connective tissue to contract, in a diminution in its size and a consequent compression of its parenchymatous structure.

Ætiology. The causation of this disease has been in too great a degree attributed to the abuse of alcohol. While there is no doubt that alcoholic beverages exercise a certain amount of influence in its ætiology, it is probably true that this influence is rather the result of their adulteration with deleterious substances and the fact that many wines are to-day artificially made from vinegar, logwood, etc., mixed with alcohol, than due to the alcohol itself. It is also true that hepatic cirrhosis may be artificially produced in the lower animals in a short time, without the use of alcohol, by the administration of lactic, butyric, acetic and valerianic acids. Of these substances, all except the last may, in the human organism, result from digestive disorders, which are frequently caused by the ingestion of sophisticated wines, such as those mentioned above, beers adulterated with picrotoxin, aloes, glucose, etc. Consequently the tendency to take a broader view of the disease should be encouraged and the cause should be sought in the alimentary canal.

Syphilis, particularly of the congenital type, is not an infrequent cause of cirrhosis, especially in children, and chronic malarial poisoning must be considered as a factor in the ætiology of this condition.

Trauma cannot be considered a true cause of hepatic cirrhosis but it may result in a localized perihepatitis beneath which a patch of interstitial cicatricial tissue may exist. This however never spreads through the organ.

The disease is usually seen in adults and in males more often than in females. It does, however, occur in children, in whom it may or may not be the result of congenital syphilis.

Pathology. The liver after death may be found to be either enlarged, of normal size, or contracted. Its surface may be smooth or nodular. On section it may be yellowish-red—especially in alcoholic patients—or yellow as a result of staining with bile pigments.

The chronic productive inflammation results in an increase in the connective tissue stroma of the organ. This new tissue may surround groups of the liver acini or may be diffusely distributed among the liver cells, which are constricted by it and it may be the seat of a fatty degeneration. The flow of blood through the organ is obstructed by the new growth of tissue and as a result of this the spleen becomes enlarged, there may be ascites and the lining of the stomach and intestines becomes congested. The increase of the stroma in the liver also may obliterate the small bile ducts and the large ones frequently are the seat of a catarrhal inflammation.

In many patients there is a general accompanying increase in the connective tissues throughout the body resulting in arteriosclerosis, fibromyocarditis, nephritis, etc.

Symptoms. The symptoms of hepatic cirrhosis may be classed as follows:

1. Those due to the co-existent inflammation of the gastric mucosa.
2. Those due to the interference with the secretion of bile.
3. Those due to the interference with the portal circulation.
4. Those due to the accompanying connective tissue inflammations in the heart, arteries, kidneys and lungs.

The gastric symptoms may by several years antedate those of the cirrhosis itself, and usually are those of a chronic gastritis, with nausea, and vomiting—which may often be the early morning "water brash" of alcoholic gastritis—eructations and constipation. The gastric symptoms are more pronounced in patients with an enlarged liver.

Jaundice of greater or less degree is a common symptom and occurs more frequently in the presence of an enlarged liver than in the atrophic form of the inflammation. With this symptom the urine contains bile and the fæces are more or less clay-colored. In certain patients a rapidly fatal form of jaundice occurs with emaciation, fever, and marked gastric and cerebral symptoms. This variety results in death within a short period.

Hæmorrhages from the œsophagus, stomach, intestines and more rarely from the uterus, nose, kidneys and bladder, are symptoms referable to the obstruction of the portal circulation by the new growth of connective tissue. They may be large and at times alarming but only seldom result fatally, their usual effect being beneficent since they relieve the portal congestion.

Dilatation of the superficial veins of the epigastrium and lower part of the chest is due to the damming back of the blood in the portal into the systemic circulation. This in extreme instances may result in the formation of the

caput Medusæ, the name given to the plexus of largely dilated veins about the umbilicus.

Ascites of greater or less degree is a common symptom of cirrhosis with a contracted liver. The abdominal fluid results from the portal obstruction and varies in quantity from a pint (½ litre) or two to an amount so large that the abdomen is distended to such an extent that there is protrusion of the umbilicus. Hydrothorax may occur and œdema of the legs may result from the pressure exerted by the ascitic fluid upon the veins returning the blood from the lower limbs. These symptoms are more frequently seen in the atrophic variety of the disease.

Splenic enlargement exists in a considerable number of patients, especially when the liver is small; often the presence of ascites makes examination of the spleen, as well as of the liver, so unsatisfactory that it is necessary to wait until paracentesis has been performed.

The enlarged liver may be tender and is usually smooth of surface, while the atrophic organ may be nodular.

The blood usually shows a considerable diminution in both red cells and hæmoglobin.

The urine of the hypertrophic liver is usually of normal specific gravity and is not likely to contain albumin. Bile pigment is frequently present. The urea content is not usually diminished.

In the urine of atrophic instances, bile pigment is seldom present, the specific gravity is low, albumin and casts may exist, the urea is usually diminished, and in the later stages of the disease blood may be found.

The symptoms of the concomitant connective tissue inflammations of the lungs, heart, arteries, etc., are those of these conditions when they occur separately.

Rise in temperature is not a feature of the disease but may occur when death is about to take place.

Physical Signs. These differ greatly in different patients and with the stage of the disease. On *inspection* the patient's skin and mucous membranes are usually seen to be pale; jaundice of the skin may be present or there may be merely the sub-icteroid hue and slight yellowness of the whites of the eyes. There may be œdema of the feet or general anasarca. When much intra-abdominal fluid is present the abdomen is likely to be prominent and tense; its superficial veins are dilated and at times the varicose condition of these structures known as the *caput Medusæ* is present. *Palpation* may reveal a large, small or normal sized liver with a rough or smooth surface. The spleen may or may not be palpable. *Percussion* may give us additional information as to the size of the liver and spleen and when ascites is present the note, while the patient lies upon his back, will be flat over the flanks, while that over the umbilical region, unless the abdominal cavity is entirely

filled with fluid, will be tympanitic. Upon turning the patient's body to its side the flatness in the flanks will be found movable if the fluid does not wholly fill the abdomen.

The physical signs of the accompanying heart, arterial, kidney and pulmonary involvement will likewise be present (see the sections upon the diseases of these structures), as well as those due to displacement of the abdominal viscera by the ascitic fluid.

The prognosis. Cirrhosis of the liver is a serious, though by no means always fatal condition. In certain instances the progress of the inflammation may cease and the patient may die of some other disease. Its course is usually chronic, lasting a year or two, although instances proving rapidly fatal have been reported. The hypertrophic form seems more rapid in its evolution than does the atrophic.

Treatment. The treatment of this condition may be separated into the following heads:

1. The diminution of the excessive connective tissue in the liver.
2. The treatment of the symptoms of the disease as they arise.
3. The prevention of further connective tissue change in the liver and consequent destruction of its parenchyma.

Toward accomplishing the first of these objects it is hardly probable that much can be done. The absorption of connective tissue growth, especially when syphilitic in origin, should always be attempted by the use of some form of iodine. Consequently this drug should be given tentatively whenever specific disease is even suspected. To achieve any effect its administration should be continued for a very considerable period. In all instances it is wise to give this agent a thorough trial. In the opinion of the author the preferable method of administering iodine is in the official syrupus acidi hydriodici of the pharmacopœia. It should be given in doses of one drachm (4.0) well diluted ½ hour before each meal, and is preferable to potassium iodide, being less likely to cause iodism.

The Treatment of Symptoms. Ascites. This symptom may be treated by, *a. Depletion by means of diuretics and purgatives:* Free diuresis may be produced and moderate ascites diminished by the administration of the Guy's diuretic pill—calomel, powdered digitalis, powdered squill, aa 1 grain (0.065)—with the addition of ¼ grain (0.016) of extract of hyoscyamus to prevent griping. One of these pills should be given 3 times a day for one week, then omitted for a week, repeated for a week and so on. Numerous other diuretic drugs may be employed in this connection. Of the potassium salts the acetate, bitartrate, or citrate may be employed; the preference is in favor of the first. It may be given in doses of 20 grains (1.33) 3 times a day. Theobrmione has given different results in the hands of different observers but the consensus of opinion that it is inferior in ascites due to hepatic cirrhosis

to a number of other diuretics. Small doses of calomel frequently repeated increase the excretion of urine. Citrated caffeine in doses of from 2 to 5 grains (0.13 to 0.33) may be employed. The fluidextract of apocynum cannabinum is an active diuretic in ascites, but should be given with care on account of its tendency to disturb the digestion. Its dose is from 10 to 20 drops (0.66 to 1.33). The resin of copaiba increases the secretion of the kidneys but on account of its liability to cause gastric irritation should be given in capsules coated with keratin, 10 to 20 grains (0.66 to 1.33) in each capsule. The fluid extract of asparagus in drachm (4.0) doses is a diuretic drug which may be tried.

Depletion by means of purgatives may be used as an adjunct to that by means of diuresis and numerous drugs of this class may be employed. Epsom salts, 2 ounces (60.0), dissolved in 4 ounces (120.0) of boiling water and allowed to cool, if given in the morning before breakfast, no liquid having been drunk since supper the night before, will produce 5 to 6 watery stools during the day. This mixture given twice a week will often ward off tapping for some time. Sodium phosphate is also an excellent purge and an hepatic stimulant as well; it may be given in doses of ½ to 2 drachms (2.0 to 8.0) at varying intervals according to the effect produced. Laxative mineral waters or their artificial salts may also be employed in this connection. Vegetable cathartics such as cascara sagrada, rhubarb, aloes and jalap may be used alternating with the salines. It is unwise to endeavor to remove ascites by marked purgation by means of the stronger hydrogogues for the attempt may be made at the sacrifice of the patient's strength.

Diminution of the ingested fluids in ascites is hardly to be advised since, while it may reduce the quantity of the transudate, this good is more than counter-balanced by the resulting diminution in the urine and tendency to constipation.

The treatment of dropsical conditions by the elimination from the diet of chloride containing substances is receiving much attention and for it great claims are made. As a tentative measure it can do no harm in cirrhotic ascites and future research may throw more light upon the subject. For a consideration of the dechloridation treatment the reader is referred to the section upon chronic nephritis.

b. Abdominal paracentesis or tapping. At the present time it is considered wise to tap the abdominal cavity as soon as the fluid is of sufficient quantity to annoy the patient; the old statement that a patient seldom survived two tappings no longer holds, perhaps because of the present lessened danger of infection and the fact that the procedure is not now employed as a last resort. Accordingly, paracentesis should be performed as soon as the fluid causes any mechanical interference with the functions of the abdominal or thoracic viscera. Complaint of discomfort on the part of the patient is an

indication for the operation as well as is a diminution of urine due to pressure upon the vessels of the kidneys by the fluid, interference with digestion or respiration due to the same cause, pulmonary congestion, as evidenced by the presence of râles at the bases of the lungs posteriorly, etc. In instances of ascites with hæmatemesis due to venous congestion in the mucous membrane lining the stomach the procedure is also indicated.

Technique of Abdominal Paracentesis. The only apparatus needed is a trocar and canula of rather small calibre ($\frac{1}{32}$ to $\frac{1}{8}$ in.) and of sufficient length to penetrate the abdominal wall of the patient in hand, and a few feet of rubber tubing to be attached to the canula, after the puncture, to lead the fluid to a vessel of sufficient size which is placed upon the floor.

The patient's bladder should be emptied, and the site of the intended puncture sterilized by scrubbing with soap and hot water, alcohol, æther and 1–5,000 mercury bichloride solution. The usual site is in the mid-line of the anterior aspect of the abdomen about equidistant between the os pubis and the umbilicus; the situation chosen must be flat upon percussion. If no fluid is obtained at the situation above mentioned the puncture may be made at about the same level either to the right or left. The right iliac fossa should be carefully avoided because of the possibility of puncturing the cœcum in this vicinity.

The trocar and canula and the operator's hands having been properly sterilized and the site of the intended puncture anæsthetized by the application of the ethyl chloride spray or the subcutaneous injection of a few drops of a 4 percent. solution of cocaine hydrochloride, the puncture is made, the trocar removed and the rubber tubing attached. The patient may remain in a sitting or semi-reclining position during the procedure and, as the fluid is drained, an abdominal binder, which is tightened from time to time, to prevent sudden intestinal distention, is applied. Should the fluid stop flowing before the abdominal cavity is empty the canula may be cleared by passing the trocar through it to dislodge any impediment. When sufficient fluid has been removed the canula should be withdrawn and the puncture dressed by the application of a bit of sterile gauze or cotton held in place by adhesive plaster or collodium. The patient should wear the abdominal bandage for several days following the operation. When a trocar of small calibre is used there is little danger that the puncture will not heal without leakage. The constipation which may follow tapping of the abdominal cavity and the possible tympanites may be relieved by saline laxatives.

c. The treatment of ascites by operation with the view of establishing a collateral circulation between the systemic and portal veins, the so-called Talma's operation, has been much discussed but its results from a curative standpoint are not all that could be desired, which fact in the opinion of some observers, is due to the procedure being usually employed as a measure of

last resort. It is possible that the results might be more favorable were the operation undertaken early in the disease. For the description of the operative technique of omental anastomosis and epiplopexy the reader is referred to works upon abdominal surgery.

Hæmatemesis. The treatment of this distressing symptom of cirrhosis of the liver differs little from that of the hæmatemesis of gastric ulcer, see p. 365. The patient should receive no food by the mouth for three or four days following the hæmorrhage and during this period food may be administered *per rectum.* The first food allowed should be in fluid form and may consist of milk, gruels, and broths, if possible partly predigested by peptonization. Gradually the patient should be brought back to solid diet (see feeding in gastric ulcer, p. 366), and after about 10 days he may be allowed to leave his bed. The after treatment consists in a regulation of the diet, only easily digested and non-irritating foods being allowed, and the administration of tonics. The patient should be advised to conduct his habits and mode of life in accordance with hygienic principles.

Hæmorrhage evidenced by the appearance of blood in the stools. Blood so changed by the fluids of digestion that it presents a tarry appearance may be voided with the fæces even when there has been no vomiting of blood. After such hæmorrhage the patient must remain quiet for a number of days and his feeding should be carefully conducted. Otherwise the treatment consists in meeting the indications as they arise.

The management of rectal hæmorrhage due to the presence of hæmorrhoids consists in treatment of this complication in accordance with ordinary methods. (see the section on hæmorrhoids.)

The treatment of concomitant digestive disturbances. Alcoholic drinks are contra-indicated and the diet should be so regulated as to prevent the formation in the digestive tract of such products of fermentation as lactic, acetic and butyric acids. The accompanying chronic gastritis with the excessive production of mucus which is of frequent occurrence may be relieved by the drinking of a glass of hot water before each meal, which tends to dissolve the mucus from the wall of the stomach, or by gastric lavage. Fermentation may also be relieved by the administration of drugs of the class of internal antiseptics such as phenyl salicylate, resorcinol, sodium phenolsulphonate and the bismuth salts, particularly the naphtholate. Small repeated doses of calomel are useful in this connection, gr. $\frac{1}{10}$ (0.006). The use of this drug will also tend to prevent constipation. The bowels should not be allowed to become constipated for this condition favors the production of the toxic substances above mentioned. Constipation may be prevented by the moderate use of salines such as sodium phosphate or sulphate, the laxative mineral waters, etc. The drinking of plenty of ordinary water is to be recommended.

Atonic conditions of the stomach call for the administration of small doses of strychnine, $\frac{1}{100}$ to $\frac{1}{60}$ of a grain (0.0006 to 0.001). The use of pepsin and other artificial digestants, in the opinion of the most advanced observers, is unnecessary.

The administration of drugs prepared with alcohol is to be avoided in so far as possible.

The prevention of further connective tissue growth in the liver is to be brought about by attention to the gastric condition, the treatment of which has been dealt with above, and by regulation of the diet and mode of life. Alcohol should be forbidden and the patient should become a total abstainer. Tobacco should be used in moderation only, if at all. The interdiction of alcohol, of course, does not apply to those late stages of the disease where its use as a stimulant is necessary. Some patients, no matter what is said by the physician, will insist upon taking a certain amount of alcohol; such should be directed to take it largely diluted and upon a full stomach.

Diet. Certain observers consider an exclusive milk diet the ideal in cirrhosis of the liver, which it no doubt is, but it will be found difficult in private practice for obvious reasons to enforce so restricted a régime. Certain patients either cannot or think that they cannot take milk, others refuse to undertake such a rigid diet. Where milk is not well borne it may be taken in the form of skim milk—which reduces its fat content—diluted with carbonic, Vichy or other mineral water. Kumyss or matzoon may be agreeable temporary substitutes for milk, but the former possesses the great disadvantage that it contains alcohol. The quantity of milk necessary is from 2 to 3 quarts (litres) every 24 hours, and it is best borne when taken in small quantities at a time. At times it may be advantageous, especially when digestion is impaired, to partially predigest the milk by peptonization. Various semi-solids such as gruels, junket, etc., which have milk as their basis, often furnish a pleasing variation to the routine. At the beginning of treatment a milk diet should usually be prescribed, to be followed, as the patient improves, by a gradual return to solids. The easily digested cereals, soft-boiled eggs, vegetable purée soups, may be given first, to be followed by a more liberal diet. All highly seasoned or spiced foods are to be forbidden, but the patient may be allowed fish or meat at one meal during the day and a moderate amount of carbohydrate food in the form of green vegetables and stewed fruit. A moderate amount of white bread either toasted or not may be permitted. Fats must be restricted since when digestion is impaired they are very prone to give rise to the fermentation products which are such a considerable factor in the causation of hepatic cirrhosis. Too much starchy food must not be given on account of the likelihood of consequent gastric and intestinal fermentation.

With regard to beverages, cocoa made with milk, tea and coffee, with the addition of plenty of milk, may be allowed.

The patient's mode of life should be modeled on hygienic lines of which regularity is the key-note. Regular hours for eating, exercise and sleep should be insisted upon. With regard to exercise a moderate amount of bicycling, walking or golf may be suggested.

Water cures at various springs and baths may often be taken in the early stages of the disease with good results. In the United States, Saratoga may be recommended and the continental spas at Carlsbad, Vichy, Marienbad and Homburg may be mentioned in this connection. It is quite as likely that the regular mode of life prescribed at places of this sort will do as much for the patient as will the bathing in or drinking of the waters.

Massage and passive muscular exercises in patients too weak to take active exercise are useful adjuncts to treatment, and abdominal massage is important in relieving the common symptom of constipation.

Drugs, other than those hitherto mentioned, have been employed in considerable number with the object of combating the disease. Claims have been made for ammonium chloride, iodoform and nitrohydrochloric acid. The administration of iodoform has been undertaken on account of its content of iodine but potassium iodide is quite as effective and better tolerated. Nitrohydrochloric acid may be given in as large doses as the patient will tolerate.

Organotherapy by the administration of macerated pig's liver and by hypodermatic injection of liver extract has been attempted and good results have been reported by a number of French observers. Apparently this form of treatment does no harm other than causing looseness of the bowels, and future experimentation may throw more light upon this interesting subject.

THE FATTY LIVER.

Ætiology. Fatty infiltration is to some extent present in the normal liver, tiny droplets of oil being always contained in the hepatic cells. In such conditions as obesity and chronic alcoholism the liver cells contain more than their normal amount of fat, the excessive quantity ingested or produced by metabolism being stored in this situation. In cachectic states, such as chronic tuberculosis, extreme anæmia, etc., there is an interference with oxidation and the ingested fat accumulates in the liver.

A third type of the fatty liver is that which occurs in phosphorus poisoning and is analogous to the change which takes place in acute yellow atrophy. The substance of the cell is converted into fat—and perhaps other substances —and necrosis follows. This is a more serious condition than the fatty infiltration observed in obesity and cachectic states.

Pathology. The fatty liver is uniformly one of the largest met as a result of pathological change. Its consistency is soft and its surface smooth; its color is light and in the later stages yellowish. Its cut surface is dry and

greasy. The increase in fat results in such a decrease in the specific gravity of the organ that it floats in water.

Symptoms. These are not characteristic. Jaundice is absent and although the fæces may be light in color there is little interference with the formation of bile. There is no ascites and the spleen is not increased in size. In obese patients the hepatic enlargement may be impossible of demonstration but in emaciated subjects the enlarged organ is easily palpated. Its consistency is inclined to be soft and its surface smooth.

The diagnosis of the fatty liver is usually not difficult. It may be differentiated from the amyloid liver by its less firm consistency, the absence of splenic enlargement and albuminuria (see also the diagnosis of cancer of the liver, p. 458).

The prognosis is that of the associated disease. Patients with fatty liver bear surgical operations poorly and often fall an easy prey to intercurrent disease, especially pneumonia.

Treatment. The treatment of the affection is that of the primary cause, such as tuberculosis or obesity. In the former condition a limitation of the ingested fats, codliver oil, etc., has been suggested. In the instances of fatty degeneration resembling acute yellow atrophy the treatment is that of this disease.

THE AMYLOID LIVER.

Synonyms. Waxy, Lardaceous or Albuminoid Liver.

Definition. An affection of the liver characterized by various degrees of infiltration of the substance of the organ by amyloid material.

Ætiology. Amyloid liver occurs as a part of the generalized waxy degeneration of the viscera which is associated with cachectic states, particularly those characterized by prolonged suppuration. It is especially common in tuberculous bone disease but is less frequent with pulmonary tuberculosis. Of other causes tertiary syphilis is important and the condition is also observed in cancerous cachexia, rickets and in protracted convalescence from the acute infectious diseases.

Pathology. The liver is greatly increased in size, it is smooth of surface and firm of consistency and its cut section has an anæmic waxy appearance. Treated with iodine tincture it turns a mahogany brown color. The degenerative process may be localized in one part of the organ and it may be associated with fatty infiltration. In instances due to syphilis the surface may be studded with nodules (gummata). The amyloid change involves the walls of the small blood-vessels, but not the liver cells. The first vessels to be attacked are those of the median portion of the lobule, later the capillaries between the lobules and their supporting connective tissue are affected.

Symptoms. These are not definite and consist chiefly of the manifestations of the primary disease. There is no jaundice but the fæces may be of lighter color than normal; the secretion of bile is not stopped. Ascites is absent but the spleen may be enlarged; this organ, with the kidneys, is usually the seat of associated amyloid degeneration. Albuminuria may be present.

Physical examination reveals a much enlarged liver of increased hardness and smooth surface, except in syphilis, when nodules may be present. The edge of the organ is often sharp and firm. There is no tenderness.

The diagnosis. An enlarged, smooth liver in a tuberculous, syphilitic or otherwise cachectic patient is almost invariably the seat of waxy degeneration. For further points in differentiation the reader is referred to the paragraph upon the diagnosis of cancer of the liver (p. 458).

The prognosis is that of the primary condition.

Treatment consists in removal of any responsible focus of suppuration by surgical means; the appropriate treatment of pulmonary tuberculosis by means of diet, tonics and change of climate, and of syphilis by potassium iodide is necessary should either of these diseases be the causative factor. The mode of life should be regulated in accordance with hygienic principles; plenty of fresh air, moderate exercise, if the patient's physical condition is fit, and simple nourishing food in proper quantity should be prescribed.

Iron, arsenic and the bitter tonics may be administered and any digestive disorders should be corrected by the usual means.

SYPHILIS OF THE LIVER.

Syphilis of the liver may be hereditary or acquired.

1. *Hereditary syphilis of the liver* occurs in an early or congenital type and as delayed heretary syphilis (*syphilis hereditaria tarda*). The congenital form is characterized by a diffuse or localized cellular infiltration. The former results in slight if any change in the gross appearance of the organ other than moderate enlargement and an increase in density; later the size of the organ may be diminished and its shape distorted due to the connective tissue proliferation and its subsequent contraction.

The circumscribed infiltration is rare and produces the gumma, a manifestation seldom observed in hereditary syphilis.

In tardy congenital syphilis the liver is also enlarged and may be the seat of gummy nodules. Its subjects are poorly developed and there may be clubbing of the fingers.

2. In *acquired syphilis of the liver* the organ may be involved during the secondary stage but tertiary lesions are much more common. With the eruption there may be jaundice and slight enlargement of the organ, acute yellow

atrophy may ensue but this is extremely infrequent, secondary syphilis of the liver being usually a mild affection.

Tertiary hepatic syphilis is not very uncommon. It may occur as a diffuse increase in the connective tissue of the organ analogous to that of ordinary cirrhosis. The new connective tissue is often unevenly distributed; most commonly, however, tertiary syphilitic disease of the liver is characterized by the incidence of gummy tumors. These are nodular growths of size varying from that of a small pea to that of a base ball; they are situated in various parts of the organ, favorite sites being the upper surface near the suspensory ligament and upon the inferior surface in the connective tissues at the hilum; gummata also are found in the parenchyma of the liver. The larger tumors tend to undergo cheesy degeneration and sometimes subsequent calcification. Following the degeneration the nodules contract and tend to distort the shape and reduce the size of the organ. On section of the liver, bands of connective tissue and the cicatrices which have resulted from the contraction of the shrunken gummata may be observed.

Symptoms. These may not suggest the nature of disease in any manner whatever unless there are manifestations of syphilitic disease elsewhere in the body. Usually the first symptoms are those of obstruction to the portal circulation; ascites may be present and there may be slight jaundice. The patient is often anæmic and his appearance and symptoms suggest malignant disease.

Physical examination may reveal the presence of a much enlarged liver with bulging of the lower ribs on the right side and prominence of the epigastrium. The organ is hard and firm; nodules may be palpable upon its surface. The spleen may be increased in size.

The diagnosis in the presence of a specific history and associated lesions is simple. The test of treatment will often render the diagnosis clear.

The prognosis in congenital syphilis is fairly good under proper treatment although in many instances the child dies within a few days of birth. In tertiary syphilis of adult life in otherwise healthy patients the prognosis under energetic treatment is also favorable but marked hepatic and splenic enlargement and jaundice are considered symptoms of bad omen.

Treatment. In the congenital form of the affection the usual treatment of hereditary syphilis in infants is indicated. Mercury may be given either by inunction or by the mouth, the former being preferable, each inunction consisting of about 15 grains (1.0) of the official ointment, a fresh site being chosen for the successive frictions as suggested under the treatment of constitutional syphilis. If it is preferred to give the drug by mouth hydrargyrum cum creta is as good a preparation as any, the dose for a child of 2 months or less being $\frac{1}{2}$ a grain (0.032) twice daily; an older child may receive 1 grain (0.065). The treatment by means of mercury should be continued daily

for several months, when intermissions of increasing length are to be advised. During the second year potassium iodide, in small doses, should be added and during the third year should be increased in amount. In the fourth year the mercury may be stopped but it is advisable to continue the administration of the iodide.

Tertiary syphilis of the liver in adults should be treated according to the usual methods employed in the third stage of the disease (see section upon the treatment of syphilis).

ACUTE YELLOW ATROPHY OF THE LIVER.

Synonyms. Acute Parenchymatous Hepatitis; Icterus Gravis; Malignant Jaundice.

Definition. An acute destructive affection of the liver characterized by necrosis and atrophy of the organ and associated with marked constitutional symptoms.

Ætiology. The disease is more common in women probably because of its frequent association with pregnancy; it is most usually seen in early adult life but has been observed in young children. It has occurred during the course of the acute infectious diseases, hepatic cirrhosis and syphilis; alcoholism and mental emotion have been considered as factors in its production. Micro-organisms, more especially the colon bacillus, have been found in the liver *post mortem* but are believed to have no connection with the causation of the disease.

Pathology. After death the liver is found to be much smaller than normal, reduction to even one-fourth of its usual weight having been observed. The capsule is loose and wrinkled, the organ is greenish-yellow in color, is flattened and flabby and there is no distinct demarcation between the lobes. The condition is similar to that which occurs in phosphorus poisoning as a result of a toxæmic catarrhal process in the smaller bile ducts. The cut section of the organ is yellow or yellow and red, the former color evidencing an earlier state of the affection. Under the microscope the liver cells are found to be in various stages of disintegration, only a few having retained their normal condition. Areas of complete necrosis are seen in which the hepatic cells have been replaced by degenerated matter consisting of fatty granular debris, bits of connective tissue, bile pigment, and crystals of leucin and tyrosin. There is a catarrhal inflammation of the finer bile passages and there may be hæmorrhages between the hepatic cells. The gall-ducts and bladder are empty. In certain instances in which the course of the disease is not acute, attempts at repair may take place either by hyperplasia of the remaining normal liver cells or reproduction of cells resembling those of the liver from those of the bile passages between the lobules.

The skin and the organs are usually bile-stained, there is splenic enlargement with granular degeneration of the renal epithelium and fatty infiltration of the cardiac muscle. There are hæmorrhages into the various tissues and the fluid in the serous sacs may be increased.

Symptoms. The first of these are those of a gastro-duodenitis with increasing jaundice. These persist from a few days to several weeks; there are headache, anorexia, nausea, vomiting and epigastric distress; these are followed, sometimes suddenly, by constant vomiting and at times by hæmatemesis, delirium, tremors, convulsions and perhaps coma. The jaundice increases, there are hæmorrhages into the skin and mucous membranes and in women abortion may take place. Fever is not characteristic and may be absent; a moderate *ante mortem* temperature seldom rising above 101° F. (38.2° C.) is not uncommon. The pulse becomes gradually weak and rapid and the so-called typhoid state becomes evident.

The diminution in the size of the liver is rapid and the shrunken organ may be impossible of demonstration by percussion owing to the tympanitic note over the hepatic region resulting from the intervention between the liver and the abdominal parietes of distended intestine. The spleen is enlarged.

The urine is of high specific gravity, colored with bile pigment and may contain casts as a result of the concomitant degeneration of the kidneys. The urea is markedly diminished, even absent at times, but the ammonia is increased. Leucin and tyrosin crystals are usually present and may be demonstrated by allowing a few drops of urine to evaporate upon a slide and examining the result with the microscope.

The fæces are usually light colored.

The diagnosis. In the early stages it is impossible to separate acute yellow atrophy from acute catarrhal jaundice and it must be remembered that cerebral symptoms may occur in this latter affection; usually the concurrence of icterus with decrease in the size of the liver, the presence of leucin and tyrosin in the urine and the symptoms of a severe intoxication render the diagnosis in the later stages simple. The small liver will differentiate the condition from hypertrophic cirrhosis, and acute phosphorus poisoning, which closely resembles acute yellow atrophy in many respects, may be separated by the absence of leucin, less amount of tyrosin, the less rapid shrinkage of the liver, the more severe gastric disturbance, the history and the milder cerebral symptoms.

The prognosis is extremely unfavorable but a few instances of recovery have been observed. The usual duration of the disease is several weeks.

Treatment. The patient should be kept at rest in bed, the diet should consist wholly of milk and other easily digestible fluids and measures should be taken to disinfect the intestinal tract and favor the elimination of toxic products from the blood. The former consideration may be carried out

most effectually by the administration of bismuth naphtholate or bismuth tetraiodophenolphthaleinate (eudoxin) either alone or combined with phenyl salicylate in proportions of 5 grains (0.33) of one of the bismuth salts to 3 to 5 grains (0.2 to 0.33) of the latter substance. A dose should be given 3 or 4 times a day. The bowels should be kept freely open by means of purges, especially calomel, which is best given in fractional doses. Elimination through the kidneys should be promoted by diuretic drugs such as caffeine, by frequent draughts of water and by large high enemata of hot normal saline solution; the latter is a most effective means of promoting diuresis and may be employed as often as 2 or 3 times daily, 8 quarts (litres) or more of the solution being given at each occasion. The hot saline is also taken up by the blood and serves to dilute the toxins circulating in this fluid; this latter consideration may also be favored by hypodermatoclysis or intravenous infusion of normal saline solution.

The vomiting may be controlled by rest, judicious feeding (diluted or peptonized milk), pellets of ice, small doses of dilute hydrocyanic acid or of cocaine hydrochloride, menthol $\frac{1}{30}$ of a grain (0.002) or a teaspoonful (4.0) of hot water frequently repeated.

For the nervous symptoms the bromides and warm baths are often effective; hydrated chloral and morphine should be employed only when absolutely necessary. In the incidence of heart weakness or collapse free stimulation is indicated.

NEOPLASMS OF THE LIVER.

Cancer of the Liver.

Of the malignant tumors of the liver carcinoma is by far the more common type, and carcinoma of the liver of internal carcinoma is only less frequent than that of the uterus and stomach. The affection is rarely primary, being in most instances secondary to similar disease of other structures. Most often it is secondary to carcinoma elsewhere in the portal area, particularly of the stomach. It is most common in men in advanced adult life but it has been observed in children. A hereditary predisposition is considered to be of some influence in its incidence.

Pathology. *Primary hepatic carcinoma* occurs in three types:

1. *Massive carcinoma* which is characterized by marked increase in the size of the organ and in which the new growth is distributed uniformly through a considerable portion of the liver. On cut section the growth is firm and of grayish-white color and the line of demarcation between it and the adjacent hepatic tissue is sharp.

2. *Nodular carcinoma.* In this type of the disease nodular growths of

varying size are distributed through the organ. One of the nodules is often firmer and larger than the others and is the primary growth from which the others have sprung.

3. *Adeno-carcinoma with interstitial hepatitis.* This is a very rare form of carcinoma of the liver in which the organ is usually small, its surface is greenish and mottled and studded with nodules. Cut section reveals firm growths in great numbers between which are bands of connective tissue. The liver parenchyma may be the seat of hypertrophy.

Secondary carcinoma of the liver is characterized by extreme enlargement, its surface is studded with nodules which are also distributed evenly through the substance of the organ; rarely one lobe only may be affected. The nodules vary in size and consistence, are whitish or yellowish in color and those just beneath the capsule may be felt through the abdominal parietes and are at times umbilicated (Farre's tubercles). Vascular rupture with hæmorrhage beneath the capsule into the gall-bladder or peritonæal cavity may take place.

Histologically hepatic carcinomata are epitheliomata of the alveolar or trabecular type. The cells are of different types, polyhedral, giant or more rarely cylindrical; at times different varieties of cells are seen in the same growth. Degeneration may take place in both the primary and secondary tumors but the latter are more particularly susceptible. The changes which may take place are of different varieties, fatty and hyaline degeneration, sclerosis and hæmorrhage, at times succeeded by suppuration, having been described.

Sarcoma of the liver is very rarely primary; secondary hepatic sarcoma is not especially uncommon. Melano-sarcoma is the most frequent type although instances of lympho-sarcoma, myxo-sarcoma and glio-sarcoma have been observed. Melano-sarcoma is usually secondary to similar growths in the orbit or it may occur in association with generalized melano-sarcoma. The occurrence of melanotic tumors in the skin may suggest the possibility of similar growth in the liver.

Symptoms. These consist of progressive emaciation, weakness and prostration, with hepatic enlargement. Digestive disorders are common, such as anorexia, nausea, vomiting and pain or a feeling of weight in the epigastrium or in the region of the liver. The pain varies; it may be wholly wanting or it may be of severe character and is sometimes referred to the right shoulder. Jaundice of moderate degree may be present; it is said to exist in about 50 per-cent. of patients. The urine is colored with bile pigments if there is jaundice but the stools are seldom clay-colored. Ascites occurs both in the rare forms of cancer with cirrhosis and as a result of pressure upon the portal vein or of peritonæal metastases. If tapping reveals the presence of blood-tinged fluid in association with a growth of the liver the probability of malignant tumor is great.

The blood is that of a secondary anæmia and consequent œdema is frequent. A febrile movement is not uncommon especially in the late stages; it is often continuous—100° to 102° F. (37.8° to 38.9° C.)—but may be intermittent. Chills may be noted.

Physical Examination. Upon inspection the patient is seen to be emaciated and cachectic in appearance. The skin may be of icteric color and there is usually a prominence of the upper abdomen with a dilatation of the superficial veins. Palpation reveals the edge of the liver from an inch or two below the margin of the ribs to the level of the umbilicus or even lower. The surface of the organ may be smooth but in nodular cancer the prominences and sometimes the depressions in their centers may be felt. Tenderness may be present. The increase in size is also evident upon percussion and it usually involves the whole organ but may affect one lobe more than the other. Splenic enlargement is not characteristic nor frequent.

Primary neoplasms may be difficult of differentiation from those of secondary type unless there is a demonstrable primary growth elsewhere in the body.

The diagnosis may be difficult in the absence of primary carcinoma of other structures. The presence of firm nodules on the surface of the organ simplifies the diagnosis but the smooth cancerous liver is a more complicated problem. It may be differentiated from the fatty liver by its hardness, the absence of cachexia and jaundice. These two latter are also absent in the amyloid liver and here the spleen is usually enlarged. In abscess we have the history of colitis or the presence of a septic temperature to aid us, the organ is usually soft and fluctuation may be elicited. The nodules which occur in hydatid disease with an enlarged liver are soft, the cachexia is not present and the course of the disease is more protracted than that of cancer. Aspiration of one of the cysts may show the presence of hooklets.

Another difficult problem is the separation of the amyloid liver with a surface studded with gummata. Here the presence of a history of syphilis and the benign course of the affection are diagnostic points. In hypertrophic cirrhosis we have an enlarged liver with jaundice but the onset of cachexia is deferred, wasting is not extreme, pain is absent, the liver is smooth and the ascitic fluid does not contain blood nor cancer cells; the spleen is usually enlarged. That form of carcinoma which is associated with cirrhosis is extremely difficult of differentiation from atrophic cirrhosis; the emaciation is, however, more rapid in the former affection.

Melano-sarcoma usually follows pigmented growths in other parts, particularly the choroid of the eye and the skin; there is great enlargement in the liver and often metastatic growths in the kidneys, lungs and other organs are present.

The importance, in instances of hepatic affection in which a malignant nature is suspected, of thoroughly searching for the presence of primary cancer

elsewhere, cannot be over-rated. The stomach, uterus and rectum, in particular, should be investigated by all the means at our command.

The prognosis of hepatic cancer is, of course, distinctly unfavorable, the condition usually resulting in death in a few months; exceptionally life may be prolonged for a year or slightly longer.

Treatment. Medical treatment can be but palliative. For the pain the hypodermatic administration of morphine may be prescribed without compunction for the character of the disease is such as to render the induction of the habit harmless. The addition of small quantities of atropine to the former drug will lessen the tendency to constipation. This symptom, when present, is preferably treated by means of the vegetable purges such as cascara, senna, aloes, etc.; the saline waters, according to German observers, should not be employed.

Hepatic pain may be relieved by the application of hot or cold compresses, poultices, anodyne plasters or counterirritants such as tincture of iodine, or liniments.

The appetite may be improved by the vegetable bitters and dilute hydrochloric acid—10 drops (0.66) in a glass of water with each meal.

Vomiting may be controlled by the administration of bits of cracked ice, sodium bicarbonate and cerium oxalate in milk, small doses of dilute hydrocyanic acid or of creosote. Gastric lavage is often effective. Intestinal fermentation is benefited by the bismuth salts especially the naphtholate or iodophenolphthaleinate in doses of 5 grains (0.33) 3 times daily.

The pruritus which sometimes accompanies the jaundice may be relieved by warm baths containing sodium carbonate, lotions of 1 to 50 phenol and the other means suggested under the treatment of catarrhal jaundice. Calcium chloride, 15 grains (1.0) 3 times daily and hypodermatic injections of pilocarpine, $\frac{1}{6}$ of a grain (0.011), are said to be effective.

The diet should be nourishing and easily digestible. Frequent small meals are preferable to larger ones at longer intervals. Milk when well borne is very valuable but if large amounts are taken at once heavy curds may form in the stomach. To obviate this Vichy or lime water may be added. Kumyss and matzoon are excellent substitutes when the patient cannot take milk or is tired of it. Meat and fats are often not well tolerated but the various meat extracts may be employed if desired. Cereals and gruels are excellent. Usually the patient may be allowed to select the foods which he likes if they are not disturbing to the digestion.

Surgical treatment may be effective when the growth is single, primary and in a favorable situation. Recovery has followed in at least one instance of secondary tumor, the primary growth in the stomach having been excised and at the same time a secondary nodule in the liver was extirpated. The advances which are daily being made in surgical technique lead us to hope that it may

soon be possible to undertake operations upon the liver which were previously considered impracticable.

If marked ascites is present repeated tapping may be necessary.

PARASITES OF THE LIVER.

Echinococcus Disease of the Liver.

Synonym. Hydatid Disease of the Liver.

Definition. A disease of the liver due to invasion of the embryo or larva of the *tænia echinococcus* and characterized by the formation of cysts within the substance of the organ.

Ætiology and Pathogenesis. The *tænia echinococcus* is a minute cestode of three or four segments and about $\frac{1}{5}$ of an inch (4 to 5 mm.) in length; the head is small and possesses four sucking disks and a rostellum with two rows of hooklets. The natural habitat of this parasite is the upper intestine of the dog. The worm is rarely met in the United States possibly because it is so small as to be easily overlooked. Echinococcus disease is most common in those countries where the relation between dogs and men is intimate, as in Iceland and Australia.

The terminal segment of the parasite, containing several thousand eggs, is cast off by the dog in the intestinal evacuations of this animal and entering the human alimentary tract with food or drink, the egg shell is dissolved and the larva is liberated. It bores its way into some branch of the portal circulation and is carried by the blood stream to the liver. Here it lodges and the hooklets, by means of which it entered the blood-vessel, disappear. The embryo now becomes a small cyst consisting of two layers, the external or ectocyst which is laminated and cuticular in structure and the internal or endocyst, a parenchymatous or germinal layer. The fluid of the cyst is clear and the whole vesicle is enclosed by a capsule of connective tissue which develops as a result of inflammatory reaction. When the primary cyst has increased to a diameter of $\frac{3}{5}$ to $\frac{4}{5}$ of an inch (15 to 20 mm.) buds develop from the germinal layer which gradually become cysts themselves with a structure identical with that of the primary vesicle. These daughter cysts are at first attached to the lining of the mother cyst but later free themselves and become in turn the parents of a third generation of vesicles.

From the granular inner layer of parent and daughter cysts brood capsules develop by a budding process, and from their lining membrane projections are formed which ultimately become scolices which really are the heads of *tæniæ echinococci* with their suckers and hooklets. These when freed and ingested by the dog may develop into the adult parasite.

The preceding is the usual form of the development of the echinococcus in

man; at other times the daughter and granddaughter cysts remain within the parent and in animals the buds may force their way between the two layers of the cyst wall and grow outward—the exogenous type. In still another type—the multilocular—the buds which are formed from the parent cyst become completely cut off and are enclosed by a firm connective tissue capsule; a number of these may unite and form a dense mass of fibrous tissue in the meshes of which are spaces of about the size of a large pea in which at times hooklets and scolices may be found.

The fluid contained in the young cysts is clear, of a specific gravity of 1,005 to 1,009 or slightly higher and contains no albumin except after a number of tappings; at times traces of sugar, succinic acid and hæmatoidin are present. Scolices and hooklets are usually found and are characteristic of hydatid disease.

The cysts vary in size from that of a pin head to 5 inches (12 cm.) or more in diameter and are of slow growth; the parasite may remain alive perhaps as long as 20 years. When death finally takes place the cyst walls contract and the contents becomes inspissated; partial calcification may occur. Rupture into the bile ducts, the vena cava, the intestine and elsewhere may take place and is a serious complication; the same is true of suppuration.

Symptoms. Small cysts are often unsuspected until revealed at autopsy. The larger ones give rise to the symptoms of hepatic tumor associated with a very slow and gradual decline in health. The large cysts cause a dragging sensation referred to the region of the liver, jaundice, if there is obstruction to the flow of bile, and when there is interference with the action of the heart or lungs, dyspnœa and irregular cardiac action.

Suppuration gives rise to a septic temperature with rigors and sweats and, if rupture takes place, various symptoms result depending upon the site of the rupture. Invasion of the lungs may be accompanied by the expectoration of sputum containing hooklets; rupture into the bile passages is succeeded by jaundice and by the evacuation of fæces in which hooklets may be found; rupture into the stomach may be followed by vomiting of hooklets and cysts; the bursting of a cyst into the vena cava causes interference with the right heart action and thrombosis of the lungs due to the lodgment of cysts. The cysts may also rupture into the pericardium in which case pericarditis ensues; into the peritonæal cavity with resulting peritonitis; or externally through the abdominal wall. Urticaria may appear coincident with rupture or even with aspiration, due perhaps to the absorption of a toxic material contained in the fluid.

The physical signs depend upon the situation of the tumor. Cysts near the upper surface of the liver may manifest themselves by demonstrable elastic or fluctuating swellings and may give the so-called hydatid fremitus which is elicited by applying one hand to the tumor and at the same time percussing

lightly with the other. The fremitus is evidenced by a vibrating or trembling movement thought to be produced by the impact of the daughter cysts against one another. A furrow may appear on deep inspiration below the costal margin and over the cyst (Lennhoff's sign).

The diagnosis often requires puncture and aspiration of the cyst contents for its confirmation; the characteristics of the fluid withdrawn are as described above. The presence of hooklets is pathognomonic, and that of glucose, probable, evidence of hydatid disease. Hepatic syphilis may be differentiated by its history, and cancer of the liver by its more rapid cachexia.

The prognosis in instances of the affection which are characterized by evident symptoms is unfavorable, unless operative interference is undertaken, except in the instance of spontaneous external rupture.

Treatment. Prophylaxis consists in impounding and destroying stray dogs and also in decreasing the number of these animals by means of an increased license fee. Strict cleanliness should be observed by those who keep dogs in the house as the ova are to a very great extent conveyed by the fæces of these animals. Where the disease is prevalent all drinking water should be filtered and boiled and all fruit and vegetables which are eaten uncooked must be thoroughly washed with filtered and boiled water. Meat should be inspected for the echinococcus and all the offal of infected sheep and oxen should be burned lest it be eaten by dogs. Pet dogs should receive an anthelmintic about once a year.

Numerous drugs have been employed in the treatment of echinococcus disease but none of them has proved of any benefit, the only efficient curative means which we possess being surgical.

Simple aspiration of the cyst contents, a canula of moderate size being employed, may result in cure but is not to be undertaken without due consideration, for death has been known to follow the operation. Aspiration is contra-indicated if suppuration is present. Aspiration with injection of antiseptic solutions such as 1 to 1,000 mercury bichloride, 5 percent. copper sulphate and 0.5 percent. beta-naphthol has been recommended but is not without danger and is to be avoided.

The treatment by means of electrolysis is carried out by passing two needles, each connected to the negative pole of a galvanic battery, into the cyst, while a sponge electrode attached to the positive pole is applied externally to the abdomen or over the cyst. Success has followed this method in a few instances but it is not to be advised.

Radical surgical treatment should always be employed when possible, the object being to remove the cyst wall and its contents entire; if this is impracticable simple evacuation of the fluid may result in cure. When suppuration has taken place the management of the condition is identical with that of abscess.

Other Parasites of the Liver.

The liver is subject to diseases due to other forms of parasites but these are rare and of interest rather to the pathologist than the practitioner. The *pentastomum denticulatum*, the larva of the *pentastomum* or *linguatula tænioides*, may be found in the organ. This is a lancet-shaped worm, the male being slightly less than an inch (1.8 to 2.5 cm.) long while the length of the female is from 3 to 5 inches (8 to 13 cm.).

The *coccidium oviforme* is common in the liver of the rabbit and may be found in the human being where it produces whitish nodules varying in size from that of a pin head to that of a small pea. The accompanying symptoms are intermittent fever, nausea, diarrhœa and enlargement and tenderness of the liver.

The *cysticercus cellulosæ* is rarely observed in the liver of man.

DISEASES OF THE HEPATIC BLOOD-VESSELS.

Anæmia of the liver is productive of no especial symptoms. The anæmic condition which is observed after death in the liver of amyloid or fatty degeneration is probably not an index of the state of the organ during life.

Hyperæmia of the liver occurs in two varieties:

1. *Active Hyperæmia* takes place after eating a full meal and is especially marked in individuals who eat and drink excessively; in these subjects the condition may even be continuous. If the over-eating and drinking is persisted in, functional disturbances and even organic structural change, consisting in an over-production of connective tissue, may result. Active hyperæmia also occurs in diabetes mellitus and in the acute infectious diseases and as a result of suppressed menstruation and after the suppression of a hæmorrhoidal flux.

Symptoms. These are not marked nor important. The condition may be the cause of the distress and feeling of weight of which persons who habitually eat and drink too much complain and which is referred to the region of the liver. The size of the organ is probably subject to daily fluctuations.

Treatment consists chiefly in dietetic measures; a moderate and easily digestible diet comprised of milk, thin soups, etc., should be substituted for that to which the patient has been accustomed. Plenty of water should be taken but alcohol, with fats and sugar, should be forbidden.

The pain and discomfort over the liver, if severe, may be relieved by the application of flaxseed poultices, cold compresses or dry cups. Intestinal antiseptics especially bismuth naphtholate or phenolphthaleinate (eudoxin) in doses of 5 grains (0.33) 3 times a day should be given, any gastric irritation should receive appropriate treatment and the bowels should be kept freely

open by means of fractional doses of calomel and the saline laxative waters. Ammonium chloride in 20 grain (1.33) doses is said to have some influence in decreasing the congestion of the affected organ.

In many instances a sojourn at one of the spas such as Saratoga, where the Hathorn water is particularly indicated, is advisable; Vichy upon the continent of Europe is recommended as a resort for these patients.

2. *Passive Hyperæmia* is a much more common and important affection than the foregoing.

Ætiology. The condition is the result of obstruction to the flow of blood through the liver to the heart. The chief cause is valvular endocarditis but passive congestion of the liver also occurs in pulmonary emphysema and sclerosis, thoracic tumors, pleuritic diseases and any condition in which pressure is exerted upon the vena cava.

Pathology. The liver is increased in size, firm in consistence and dark reddish in color. Its vessels are distended with blood, the intra-lobular vein and the neighboring capillaries being especially affected in this respect. On section the "nutmeg" appearance, which is the result of the alternating hyperæmia and anæmia of the hepatic and portal districts, is apparent. The increasing distention of the vessels in the central portions of the lobules finally results in an atrophy of the adjacent liver cells; there is a deposition of dark pigment, the blood-vessels are finally occluded and there is an increase of connective tissue. In the final stage of chronic passive congestion the organ is decreased in size but its surface is smooth in contra-distinction to the condition obtaining in atrophic cirrhosis in which the surface of the liver is roughened.

Symptoms. There is usually gastric irritation with vomiting, sometimes of blood; ascites, at times followed by general œdema, is common in the later stages. There may be slight jaundice, with dark urine and light colored stools.

The physical signs consist of a primary enlargement of the liver, often with tenderness, followed by a contraction of the organ. The enlarged liver may pulsate as a result of the regurgitation of blood from the right side of the heart. This is not to be confounded with the throbbing which may be transmitted from the over-acting heart. In this latter condition the liver appears to move downward while in the former the organ appears to dilate uniformly. The spleen is often increased in size.

Treatment consists in restoring the circulation to its normal state which is often possible, when the condition is the result of valvular heart disease, by the administration of cardiac tonics. Co-existing pulmonary disease should receive appropriate treatment and abdominal paracentesis may be necessary. Confinement to bed is usually indicated.

The congestion of the liver may be further relieved by saline laxatives and hydrogogue cathartics such as elaterium, jalap, etc. Calomel and blue

mass are also valuable. The method of depletion advocated by Hay, which consists in the administration before retiring of 2 ounces (60.0) of magnesium sulphate which have been dissolved in boiling water and then allowed to cool, is an excellent method of relieving the portal congestion. The general dropsy may be diminished by eliminating the chlorides from the diet (see the section on the treatment of the œdema of chronic nephritis). The withdrawal of from 15 to 20 ounces (450.0 to 600.0) of blood directly from the liver may be practised but is not without danger.

The pain over the liver may be relieved by the means suggested in acute hepatic congestion (p. 463). The diet should be nourishing and easily digestible because of the possibility of increasing the dropsy.

During convalescence a residence at one of the water cures suggested under the treatment of active hyperæmia is often of benefit to the patient.

Thrombosis and Embolism of the Portal Vein.

Thrombosis of the small branches of the portal vein occurs as a result of the obliteration which takes place in hepatic cirrhosis; obstruction of larger branches may follow cancerous invasion, the lodgment of a parasite or of a calculus which has ulcerated through the vessel wall. The blood may coagulate in the vein in cirrhosis and syphilis of the liver or the vessel may become occluded as a result of a proliferative inflammation of its wall. Collateral circulation may become established around the obstruction and the affected vessel may degenerate into a fibrous cord.

Symptoms. Associated with those of cirrhosis or of another of the causative conditions the sudden occurrence of ascites, extreme distention of the branches of the portal circulation with splenic enlargement, hæmatemesis and bloody stools, is suggestive of portal thrombosis. The diagnosis is a very difficult one.

Hepatic infarct is not common and is of no especial clinical importance except when the embolus is septic.

Pylephlebitis is probably consequent upon portal thrombosis but is of no particular significance unless the thrombus is infective. Septic pylephlebitis follows the lodgment of an infective embolus from some part of the territory of the portal circulation. It may occur in dysenteric conditions or in sepsis of the umbilical vein in the new-born; its chief importance is its relation to hepatic abscess.

The symptoms are the usual ones of pyæmic infection, irregular temperature with rigors, sweats and prostration. There is usually pain over the liver and jaundice with the manifestations of portal obstruction. Co-existent purulent peritonitis has been observed.

Changes in the Hepatic Artery and Vein are uncommon. The artery

may be the seat of dilatation in cirrhosis of the liver. Arteriosclerosis and endarteritis as well as aneurysm of the hepatic artery have been observed. The last of these is evidenced by an expansile tumor over which a *bruit* may be audible. Its symptoms are pain over the liver, jaundice from obstruction of the biliary ducts due to pressure, melæna, and the vomiting of blood.

The hepatic vein may be dilated in conjunction with right cardiac enlargement. Embolism from the right auricle has been noted and a stenosis of the openings of the veins has been described as occurring in connection with a fibrous obliteration of the inferior vena cava.

DISEASES OF THE BILIARY TRACT.

JAUNDICE.

Synonym. Icterus.

Definition. A condition, rather sypmtom than disease, characterized by a yellowish discoloration of the skin and other tissues, as well as of the body secretions, by the bile pigments. Jaundice was formerly considered as occurring in two types, *hepatogenous*, or obstructive, and *hæmatogenous*. At present it is held as probable, if not certain that there is no hæmatogenous jaundice but that obstruction is responsible for the condition in all instances.

Obstruction to the normal flow of bile and consequent jaundice may result from various causes of which the following are the most frequent: 1. Inflammation with accompanying swelling of the duodenal mucous membrane or of the lining of the bile duct. 2. Pressure upon the bile ducts exerted from without such as may occur in instances of tumors of the gall-bladder, liver, pancreas or stomach, particularly cancer of the pylorus. Omental tumors, displaced kidneys, enlarged glands in the fissure of the liver, fæcal masses, the pregnant uterus and aneurysms of the abdominal vessels are less common external causes of obstruction. 3. Obstruction of the biliary passages from internal causes such as calculi, parasites, inflammatory strictures or tumors of the duct itself or of the duodenum at its orifice. 4. Reduced pressure in the hepatic blood-vessels, while a higher pressure obtains in the bile passages, favors the resorption of bile from the latter.

Acute Catarrhal Jaundice.

Synonyms. Duodeno-cholangitis; Icterus Catarrhalis; Inflammation of the Common Bile Duct.

Definition. An affection characterized by icterus of the tissues occurring as a result of an obstruction to the flow of bile due to a catarrhal inflammation of the mucous membrane of the bile ducts and of the duodenum.

Ætiology. Cholangitis is usually a sequence of the extension of an inflam-

mation of the gastric and duodenal lining into the common bile duct. These latter conditions may be caused by exposure, errors in diet, over-indulgence in alcohol, tea or coffee, over-work, mental emotion, or they may complicate the acute infectious diseases such as pneumonia and enteric fever. The passive congestion which occurs in chronic endocarditis and nephritis may also result in jaundice of this type. An epidemic catarrhal jaundice has been described.

Pathology. The distinctive lesion is a swelling and congestion of the mucous lining of the common bile duct; the process may extend to the cystic duct or even to the hepatic duct and its ramifications. The lumen of the duct is usually filled with mucus, a plug of which often occludes its orifice. This plug may be expelled by pressure, following which free passage is afforded to the bile. The liver itself may be slightly swollen, its color is lighter than normal and its tinge icteroid. If the affection is protracted the retained secretion may cause sufficient irritation to bring about an increase of the connective stroma of the organ and a consequent cirrhosis with atrophy of the hepatic cells may result.

Symptoms. Usually manifestations pointing to gastric disturbance, such as anorexia, a coated tongue, nausea, vomiting and constipation, are first noticed. Pain is not common but there may be slight epigastric tenderness; a slight febrile movement is not infrequent. Following these symptoms the jaundice appears. The sclerotics may be first discolored, the face and neck are also early involved; thence the yellow color spreads over the whole body including the mucous membranes. Even the perspiration may be tinged. In instances of long standing the color deepens to a brownish or greenish-yellow. The urine is dark reddish-brown or dark green and when shaken its foam is of a yellow color. In protracted instances albumin and casts may be found, the latter often being bile stained.

Constipation is usually present, the stools are foul of odor and light grayish or clay-colored. Rarely there may be diarrhœa.

Infrequently the tears, saliva and milk are tinged with yellow.

The pulse rate is slowed, at times being even as low as 30 beats per minute. The respiration is unaffected.

There is often an annoying itching of the skin and such cutaneous lesions as urticaria, furunculosis, lichen and xanthelasma, a manifestation consisting of slightly elevated yellow macules occurring upon the eyelids and rarely upon other parts, may be observed. In grave instances of the affection ecchymoses and even large hæmorrhages may appear in the skin and mucous membranes.

Symptoms referable to the nervous system are common. The spirits are depressed and the patient may be melancholic. The temper is irritable and headache and dizziness are common. Visual disorders may occur, objects may appear to be of a yellow color, the patient may see better by a

dim light or vision in the dusk may be indistinct. Marked and severe nervous symptoms occur in grave instances of jaundice but more particularly in association with acute yellow atrophy, carcinoma and fatty degeneration of the liver than in catarrhal inflammation of the bile passages. These symptoms are acute delirium, convulsions or suddenly appearing coma. Usually there are accompanying fever, rapid pulse and prostration, which with the nervous manifestations, comprise the symptom complex to which the term *cholæmia* has been applied; this condition is probably due to the presence in the blood of some poisonous constituent of the bile.

Physical examination may reveal the presence of a more or less enlarged and tender liver; sometimes the gall-bladder is distended and palpable.

The diagnosis. Jaundice occurring acutely with symptoms of gastro-duodenitis, a history of dietary indiscretions and in the absence of manifestations suggestive of acute yellow atrophy, carcinoma or hepatic cirrhosis is distinctive of catarrhal obstruction of the bile passages. The pigmentation of the skin of Addison's disease may be mistaken for jaundice but in the former condition the eyes are not colored and the fæces are not clay-colored. The same is true of the cutaneous discoloration observed in uterine affections, malaria and cancer.

The prognosis of uncomplicated catarrhal jaundice is uniformly favorable. The duration of the disease is usually from 10 days to 8 weeks; if the course is protracted beyond this limit the possibility of mistaken diagnosis must be considered. A febrile movement and the incidence of hæmorrhages are unfavorable manifestations.

Treatment. The patient should be kept in bed while there remains any elevation of temperature and while there are active symptoms of gastric irritation. While there is interference with the flow of bile the food should be such as does not need this secretion to promote its digestion and assimilation, consequently fats are to be avoided. Milk, however, while containing a certain amount of fat, seems to be well borne, and though it may seem advisable to remove the cream, this need not be done. Other substances which are allowable are egg-albumin and meat broths. As the digestive irritation diminishes and the flow of bile increases the diet may be more liberal and we may add eggs, fish and other non-irritating foods. When the bile stasis persists for some weeks and a generous diet is needed to maintain the patient's nutrition the fats should be replaced by carbohydrate foods. In convalescence small meals taken frequently are to be preferred to those of large amount at more infrequent intervals. The diet in any individual instance should be governed by the condition of the stomach and intestine, consequently it may be said that the feeding in catarrhal jaundice after the acute stage is passed is that of gastro-intestinal catarrh.

At the beginning the bowels should be freely opened by small repeated

doses of calomel—$\frac{1}{4}$ grain (0.016) every $\frac{1}{2}$ hour until 6 doses have been taken—followed by a saline; here we may give the natural Carlsbad salt in doses of 2 or 3 drachms (8.0 to 12.0), Hunyadi, Apenta or any of the similar laxative waters. During the progress of the affection free daily evacuations should be induced by the administration of salines such as magnesium or sodium sulphate, sodium phosphate, Carlsbad salts or Vichy, Hunyadi, Friedrichshall, Rubinat or Saratoga Hathorn waters. By this means the catarrhal process in the duodenum is lessened and the mucus is dissolved from the lining of this viscus. The drastic vegetable purgatives should be avoided on account of their irritant properties.

The patient's thirst may be relieved by any of the palatable alkaline waters such as Vichy, and frequent draughts will aid in freeing the duodenum from its accumulated mucus, thus acting in connection with the laxatives suggested above.

In relieving the stasis of bile and hastening the flow of this secretion no drug is more active than salicylic acid in doses of from 10 to 20 grains (0.66 to 1.33). Calomel, also, has been suggested in this connection but its cholagogue action is disputed in the light of our present knowledge. Its effect is evidenced by a return of the stools and urine to normal color rather than by a disappearance of the jaundice. High rectal enemata of ice water may assist in removing the plug of mucus from the opening of the bile duct; their action is probably due to a stimulating effect upon peristalsis. Massage over the region of the gall-bladder may be employed in the hope of stimulating the flow of bile and the same may be stated concerning the faradic current, which should be used in considerable strength. While not much is to be expected of these latter measures their employment is, to say the least, harmless.

The gastric irritability may be relieved by regulation of the diet and by the administration of sodium bicarbonate in watery solution or in connection with cerium oxalate—20 grains (1.33) of the former and 10 grains (0.66) of the latter being added to each glass of milk that the patient takes. Plain water, taken in considerable amount and as hot as possible, is often effective. If there is uncontrollable vomiting all food should be stopped, the patient being allowed to suck bits of cracked ice; small doses of dilute hydrocyanic acid may be effective in combating this symptom.

Diarrhœa is uncommon but if present may be controlled by means of bismuth subsalicylate or subnitrate in the usual doses or still better by such intestinal antiseptics as bismuth naphtholate—gr. 5 (0.33) three or four times a day—combined with an equal amount of phenyl salicylate (salol) or 2 or 3 grains (0.13 to 0.2) of resorcinol.

When the symptoms of gastro-intestinal irritation have ceased we may substitute for the remedies previously given for their relief a bitter tonic such as the following: ℞ acidi nitrohydrochlorici diluti, ℥vi (24.0); fluidextracti

nucis vomicæ, fluidextracti gentianæ, aa ℥i (4.0); aquæ cinnamomi q.s. ad ℥iv (120.0). One teaspoonful to be taken in a little water before each meal. Instead of this 10 minims (0.66) of dilute hydrochloric acid may be added to a tumblerful of water and drunk with the meals.

The pruritus may be relieved by warm baths to which a pound (1500.0) of sodium bicarbonate has been added, by lotions of 1 to 60 phenol, 10 percent. menthol in albolene, by powdering the skin with talc, bismuth subgallate or zinc stearate and by the administration of calcium chloride in doses of from 15 to 20 grains (1.0 to 1.33) 2 or 3 times daily or of a powder containing 10 grains (0.66) of sodium bromide and five (0.33) of antipyrine at similar intervals.

In persistent instances of the disease the patient will usually derive much benefit from a stay at one of the spas such as Saratoga or Bedford in the United States, Harrogate in England or Vichy or Carlsbad upon the continent. Here the good effect of the internal use of the waters, of the bathing and of the systematic life will soon be felt.

Toxic Jaundice.

This type of jaundice, formerly considered hæmatogenous in origin, is now held to be the result of biliary obstruction caused by increased viscidity of the bile accompanied by cholangitis.

Toxæmic jaundice is produced by the following causes:

1. The action of such poisonous substances as arsenic and phosphorus.
2. Specific infectious diseases such as yellow fever, malaria, enteric and typhus fevers, pyæmia, scarlatina, etc.
3. Obscure conditions, probably of infectious origin such as Weil's disease or acute febrile jaundice, and acute yellow atrophy of the liver.

The poisons are believed to cause obstruction in the following way: there is destruction of the blood by hæmolysis which results in the liberation of hæmoglobin and an increased production and excretion of bile pigment; the bile becomes more viscid and produces a transient obstruction with reabsorption of bile and consequent jaundice. As the toxæmia disappears the viscidity of the bile becomes diminished, the secretion flows more freely and the jaundice disappears.

The symptoms of toxic icterus are less marked than those of the more truly obstructive type of the affection; while the skin may be yellowish the stools are seldom clay-colored and, although the urine may be darkened, there is a conspicuous absence of bile pigment. In some instances there are extremely severe constitutional symptoms such as high fever, great prostration, marked mental disturbances, coma, anuria and hæmorrhages into the skin and from the mucous membranes.

Icterus Neonatorum.

Jaundice is a common manifestation in newly-born infants. It occurs in both a mild and a severe type. The former is quite common and often makes its appearance within 2 or 3 days of birth. Its cause is not definitely known but it is probably due to biliary stasis in the smaller bile ducts. Certain authorities have attributed it to the destruction of red blood cells by hæmolysis, the jaundice resulting in the same fashion as in toxic icterus. The condition is characterized by yellowish discoloration of the skin, darkened urine and light colored stools. There is seldom any digestive disturbance and the symptoms usually disappear within a week or two.

The grave type of jaundice of the newly-born may be the result of congenital absence of the common or hepatic ducts, congenital syphilitic inflammation of the liver or of septic phlebitis of the umbilical vein. The outcome is usually fatal.

Treatment. The mild form of infantile jaundice needs no treatment. Treatment of the severe form is fruitless unless the condition is due to syphilitic hepatitis, when anti-luetic measures are indicated.

ACUTE CHOLECYSTITIS.

Synonyms. Acute Infectious Cholecystitis; Acute Inflammation of the Gall-bladder.

Definition. An acute inflammation of the gall-bladder resulting from the invasion of pathogenic micro-organisms.

Ætiology. Although the presence of biliary calculi in the bladder itself or in the ducts leading to this structure, is an important predisposing cause of infectious cholecystitis, the inflammation may occur in their absence. The direct cause of the affection is infection with some one of the pathogenic bacteria, especially the streptococcus, the staphylococcus, the pneumococcus and particularly the colon bacillus and the bacillus of enteric fever. As predisposing factors other than biliary calculi all obstructive influences, such as inflammatory adhesions or catarrhal inflammation of the lining of the cystic duct, must be considered since they diminish the local resistance to bacterial infection.

Pathology. This depends upon the activity of the infective process. Usually the gall-bladder is distended and tense, its lining is congested and its cavity contains dark muco-pus, sanious pus or pus. Gangrene with perforation may take place, in which case the contents of the gall-bladder is of foul odor. The perforation may be shut off by adhesions and form a localized abscess cavity or it may result in a generalized infection of the peritonæum. Inflammatory adhesions to adjacent structures, particularly the colon and

omentum, are common. The cystic duct may be occluded by an impacted calculus or by inflammatory swelling of its wall.

Symptoms. The affection may first indicate its presence by perforation but usually the earliest symptom to be noted is pain, often sudden and paroxysmal, referred to the region of the liver. In some instances the pain is farther to the left than this situation and it may even be as low as the right iliac region. There are early symptoms of gastric irritation such as nausea and vomiting; there is prostration with a rise of temperature often accompanied by rigors and sweats. The pulse is usually accelerated but at times may be extremely slow. Jaundice is rare unless the hepatic or common duct is involved.

Palpation of the abdomen elicits tenderness, often extreme and generally localized, but at times in an unexpected situation. There is rigidity of the abdominal muscles and the distended gall-bladder may be felt. Adhesions between the intestine and the gall-bladder may result in the partial or entire occlusion of the bowel with attendant symptoms.

The diagnosis. Here the history is of great value, symptoms suggestive of cholecystitis and yet resembling those of appendicitis or those of intestinal obstruction when occurring after pneumonia, enteric fever or previous affections of the biliary tract, being much less puzzling than when they appear independently. In the absence of history it is often very difficult to differentiate acute cholecystitis from appendicitis, pancreatitis and localized peritonitis. Jaundice is more likely to appear in pancreatic disease but the true nature of the condition is often not determined until laparotomy has been performed.

The prognosis naturally depends upon the type of infection and its severity; the acute suppurative form is a grave condition on account of the probability of perforation peritonitis, local or general; in the latter instance death is certain unless operation is undertaken.

Treatment. The mild types of the affection in which there is no distinct evidence of suppuration should be treated by rest in bed and light diet. Salicylic acid or sodium salicylate, preferably the former, should be given 3 times daily in doses of about 10 grains (0.66) in order to increase the bile flow and to prevent extension of the inflammatory process into the ducts. The bowels should be kept open by means of mild laxatives and the pain may be relieved by the application of hot or cold compresses; morphine should not be given unless absolutely necessary for it is apt to obscure the symptoms. Nausea and gastric irritation may be controlled by the usual means. Methylthionine hydrochloride (methylene blue) in capsules containing 1 grain (0.065) and sodium succinate in doses of 5 grains (0.33) have been recommended.

Upon the incidence of the slightest signs of suppuration immediate surgical interference, consisting of free incision and drainage of the gall-bladder, is indicated.

CHOLELITHIASIS.

Synonyms. Gall-stone Disease; Biliary Calculus; Hepatic Calculus.

Ætiology. Biliary calculi are either (1) hepatic in source, originating in the bile ducts because of a slow catarrhal process which results in the secretion of an albumin substance, which in combination with the bile precipitates a bilirubin-calcium calculus, or (2) are formed in the gall-bladder because of a low grade catarrhal process which induces a secretion of cholesterin from the mucous glands and cells of its walls. Of these the former origin is by far the more frequent. This explanation of the source of gall-stones also accounts for the fact that oftentimes after the performance of a cholecystotomy gall-stones continue to be discharged from the fistula for weeks and even months. It also points out why removal of the gall-bladder itself is not followed by a cessation of attacks of gall-stone colic.

The recognition of the microbic origin of biliary calculi dates only to 1886. In 1897 it was clearly shown that the colon bacillus could be responsible, gaining access by either (1) the intestinal canal by way of the common duct, or (2) through the portal vein. Although jaundice as a sequel to enteric fever had been observed as early as 1826, it was not until 1889 that the typhoid bacillus was recognized as a causative factor entering by way of (1) the portal vein, (2) the hepatic artery, or (3) the common duct. That other infections are also directly responsible has been shown, for low grade cholecystitides have been observed after acute infectious pneumonia, acute rheumatic polyarthritis and chronic tuberculosis. That gall-stones do not oftener result, the explanation may be that acute suppurative inflammations of the bile ducts or gall-bladder do not result in calculi but rather these are due to attenuated infections.

The mechanical causes of gall-stones: (1) Foreign bodies if sterile are harmless. If they produce stagnation they favor catarrhal processes and so give opportunity for infection. (2) Stagnation of bile in itself does not favor calculus formation but since stagnation favors infection it may lead directly to the formation of stone. (3) Chronic venous congestion of the portal system is a more potent cause of the production of gall-stones since it is the great underlying cause of cholelithiasis. The congestion of the portal circulation may occur as a result of (*a*) chronic heart disease—especially mitral obstruction—(*b*) chronic pulmonary disease—particularly chronic emphysema and chronic interstitial pneumonia—(*c*) intestinal catarrhs due to the abuse of alcohol, gluttony and rarely to the excessive employment of vigorous purgatives; a more common cause of intestinal catarrh than any of the preceding is constipation which not only predisposes to infection but offers opportunity for auto-intoxication. (4) Of mechanical causes, not hitherto enumerated, worthy of mention are (*a*) pregnancy, (*b*) visceroptosis—

Glénard's disease—(*c*) over-fitted hepatic flexure of the colon, (*d*) displacements of the duodenum, all of which may cause biliary stasis and, as above mentioned, predispose to the production of gall-stones. (5) Of extraneous causes anything which reduces the vitality of the individual such as (*a*) anxiety, (*b*) bodily exhaustion from excessive physical or manual labor, or (*c*) wasting diseases may be mentioned.

Gall-stones may be single or multiple; they are usually brownish in color, rounded, oval or polyhedral in shape. In size they vary from that of a millet seed to even 5 inches (12 cm.) in length. The small calculi are often very numerous, thousands having been found in a single gall-bladder. A number of stones impacted together become faceted as a result of their pressure upon one another. Irregular (mulberry) calculi are sometimes found. Section of a gall-stone reveals a nucleus usually consisting of bile pigment or more rarely a foreign body. Collections of micro-organisms are said to have been found at the nucleus of certain kinds of gall-stones. Chemically the calculi consist chiefly (70 to 80 percent.) of cholesterin arranged concentrically. In some instances the stone is composed wholly of this substance, usually, however, other constituents such as bile pigment, calcium carbonate, magnesium salts, fatty acids, organic matter and traces of copper and iron, are found. Rarely calculi may be composed almost wholly of bilirubin-calcium. The most common type of gall-stone is the mixed cholesterin calculus; this is yellow, brown or white and is generally faceted. Mixed bilirubin and cholesterin stones consist of a nucleus of the latter substance covered by dark brown material.

Calculi are formed in the gall-bladder where they may exist, as stated, in enormous number; they may also be formed in any part of the biliary tract either without or within the substance of the liver. Lodgment of calculi often takes place in the cystic and common ducts. In the latter the point of lodgment is usually in the ampulla of Vater; dilatation of the duct behind the obstruction may take place. Obstruction of the cystic duct, if permanent, results in dilatation of the gall-bladder, which may be so distended as to be mistaken for an ovarian cyst. The contents of the bladder is a colorless, sometimes viscid, fluid of neutral or alkaline reaction and contains albumin. The gall-bladder which contains calculi is not enlarged except in so far as the contained stones increase its size (Courvoisier's law). Ulceration or suppuration may result from the presence of a calculus and rupture may take place into any adjoining structure.

Symptoms. In many instances the presence of biliary calculi causes no symptoms as is shown by the facts that *post mortem* records prove that from 6 to 10 percent. of all cadavers evidence the existence of gall-stones, while not more than 1 person in 20 of those who carry calculi becomes aware of their presence through any symptoms which may result from them.

The manifestations of the presence of gall-stones may be considered under several headings:

1. *Biliary colic* is due to acute impaction resulting during the passage of stones through the larger bile ducts. The passage of the calculus usually gives rise to severe attacks of pain which is sudden in onset and referred to the epigastrium or right hypochondrium whence it may radiate to the right shoulder or to any part of the abdomen. The pain is excruciating and lancinating in character and may cause syncope. The liver may be enlarged, tenderness is usually present and the gall-bladder may be palpable; there is abdominal rigidity; nausea and vomiting occur. There are often chills; the temperature rises to 102° to 103° F. (38.9° to 39.5° C.) or even higher. The fever may be intermittent in type but is more apt to assume this form in protracted obstruction due to chronic impaction of calculi (intermittent hepatic fever). There may be circulatory depression with rapid and feeble pulse.

There is usually splenic enlargement and, if the attack is prolonged, jaundice is likely to appear, particularly if the stone becomes impacted in the opening of the common duct. The paroxsym of colic varies in duration from a few hours to a week or more; it may recur at intervals, the symptoms ultimately disappearing with the passage of the calculus.

Rupture may take place at the site of the obstruction with death from peritonitis as a result; convulsions have been observed.

The diagnosis is seldom difficult; the site of the pain is characteristic and its occurrence with tenderness over the liver, a chill and jaundice leaves hardly room for doubt. The history is often of marked assistance. Renal colic is accompanied by pain radiating downward to the groin or testicle and by bloody urine which often contains pus cells. Appendicitis, while it may be associated with pains similar to those of hepatic colic, is not attended with jaundice. The *pseudo-biliary colic* which may occur in women may be differentiated by the absence of jaundice and the presence of nervous symptoms of various kinds. Finding calculi in the fæcal discharges is confirmatory of the diagnosis of gall-stone colic. A search for these should always be made in suspicious instances during the three or four days following an attack. The stools should be washed upon a fine seive until all soluble matter has been flushed through.

The prognosis as to recovery from the paroxysm is favorable, death from syncope, perforation or convulsions being a rare occurrence.

2. *Chronic Impacted Gall-stone:* During the passage of a calculus through the ducts toward the duodenum impaction not infrequently takes place. The impaction may occur,

a. In the Cystic Duct.

Symptoms. These may resemble in greater or less degree those of acute impaction with added dilatation of the gall-bladder (*hydrops vesicæ felleæ*). The

dilatation is the result of the accumulation of the exudation due to inflammation of the lining mucous membrane plus the bile that was present when the obstruction took place. The increase in the size of the gall-bladder may be great and the condition has been mistaken for ovarian cyst. On opening the gall-bladder the fluid contents is found to consist chiefly of mucus of alkaline or neutral reaction. Jaundice may not be present and, while at times the distended gall-bladder may not be palpable, it may often be felt as a rounded or gourd-shaped fluctuating tumor projecting downward or to the left toward the mid-line of the abdomen. If the abdominal wall is thin and relaxed crepitus due to the presence of calculi may be demonstrated.

b. Impaction in the Common Bile Duct.

Symptoms. The obstruction may be due to one or several stones firmly fixed in any portion of the duct or in the ampulla of Vater. If a considerable number of calculi is present these may fill the hepatic and cystic ducts as well. Dilatation of the gall-bladder to a slight degree may be observed but is by no means constant. Cholangitis is a usual sequence and may be either of chronic catarrhal or of suppurative type.

In *chronic catarrhal cholangitis* due to permanent obstruction there is marked and permanent jaundice, nausea and vomiting may be present and the condition may be differentiated from obstruction due to neoplasm by the history of previous colic, the pain, which may be intermittent, and the absence of increase in the size of the gall-bladder. A limpid mucoid fluid is usually found in the distended ducts.

Naunyn mentions the following diagnostic signs of calculus in the common duct: "(1) The continuous or occasional presence of bile in the fæces; (2) distinct variations in the intensity of the jaundice; (3) normal size or only slight enlargement of the liver; (4) absence of distention of the gall-bladder; (5) enlargement of the spleen; (6) absence of ascites; (7) presence of febrile disturbance, and (8) duration of the jaundice for more than a year."

Incomplete obstruction with infective cholangitis is usually evidenced by rather typical symptoms but the causative condition, which may be either a number of stones in the common duct, one of which is movable, or the so-called ball-valve calculus which is most often found in the ampulla of Vater, but sometimes in the common duct; this may exist without causing any suspicion that gall-stones are present. The ball-valve calculus evidences its presence by a rather characteristic train of symptoms which consists of a febrile movement occurring in malaria-like paroxysms and associated with rigors and sweats (*intermittent hepatic fever*) and persistent jaundice of varying degree but which is intensified after each febrile paroxysm, this last often being accompanied by the manifestations of gastric irritation and hepatic pain. Such manifestations may appear from time to time during a period of several years without the incidence of suppurative inflammation. The

rises in temperature are probably due to some mild infection, possibly the result of the presence of the *bacillus coli communis* although they have also been explained upon the ground of irritation. In the diagnosis of common duct obstruction it is to be remembered that this condition, when due to stone, does not give rise to dilatation of the gall-bladder. This rule (Courvoisier's law) is valid in about 90 percent. of cases but the following exceptions have been mentioned by Moynihan: "(1) When there is a stone or a stricture in the cystic duct causing hydrops or empyæma, together with the acute impaction of a stone in the common duct; (2) where there is a stone in the cystic duct pressing upon the common duct; (3) when there is distention of the gall-bladder by an acute inflammatory process, with obstruction of the common duct by stone; (4) where there is chronic induration of the head of the pancreas, with a stone in the common duct; (5) where there is malignant disease of the common duct at any part of its course, or cancer of the head of the pancreas, and a chronic sclerosing cholecystitis."

Suppurative cholangitis is evidenced by a fever of more distinctly septic character than that just described; the remissions are less distinct and shorter and with the paroxysms there is no augmentation of the jaundice. There are hepatic tenderness and enlargement and the suppurative process often extends into the ducts in the liver, causing abscess, as well as into the gall-bladder. The evolution of the condition is shorter than that of infective cholangitis and death is the usual termination. *Post mortem*, the mucous lining of the ducts is found thickened and perhaps ulcerated; abscess may be present in the liver substance and pus may distend the gall-bladder. Rupture of this viscus has been observed.

Remote effects of impaction of gall-stones: Biliary fistulæ are not infrequently observed. The fistulous opening most commonly met is that in which external perforation through the skin has taken place; the most usual situations are the right hypochondriac and the umbilical regions. Gall-stones may be discharged and recovery, even without operation, may follow. Ulcerative perforation may take place into the peritonæal cavity with localized abscess formation, general peritonitis or retro-peritonæal perforation. Communications between the bile ducts themselves, the gall-bladder or the intestine are common, the usual exit of large calculi being through a colonic perforation. Fistulous openings into the portal vein and stomach are rare. Perforations into the pleura, lungs and urinary passages have been observed.

Septic cholecystitis, empyæma of the gall-bladder, may follow the suppurative cholangitis of impacted stone. Calcification of the mucous lining or of the entire wall of the bladder may supervene upon purulent inflammations and atrophy of the viscus may take place after the excessive dilation of hydrops. Suppurative pylephlebitis or hepatic abscess may result from purulent cholangitis. Intestinal obstruction due to biliary calculus, the stoppage being most usually observed at some point in the ileum, is not very uncommon.

Of the other results of gall-stone disease the following should be mentioned: 1. Diabetes mellitus. Gall-stone impacted in the lower end of the common duct or in the diverticulum of Vater may lead to infection, as previously stated, chronic interstitial pancreatitis and destruction of the islands of Langerhans. 2. Glycosuria from the same course of events with interference with the functions of the islands of Langerhans. 3. Chronic interstitial pancreatitis with amylaceous or lipatic indigestion and malnutrition. 4. Gall-stone impacted in the duodenum allowing penetration of bile into the duct of Wirsung with hæmorrhagic pancreatitis.

The diagnosis of the condition of intermittent hepatic fever is usually not difficult, its peculiar febrile movement with rigors, sweats and jaundice being characteristic. Cancer of the gall-bladder is not associated with a rise in temperature, is characterized by greater tenderness and more rapid emaciation. The use of the aspirating needle is quite justifiable as a means of differentiation.

In making a diagnosis of gall-stone disease the frequency of biliary calculi in elderly persons as a result of senile atrophy of the smooth muscle tissue in the walls of the gall ducts and bladder, should not be forgotten.

The *Röntgen ray* is much less efficient as an aid in the diagnosis of hepatic calculi than in that of renal or ureteral stone. Plates showing gall-stones have been obtained but the chance of successful demonstration of a calculus is small, the material of which most of these are formed offering little obstruction to the ray. Cholesterin stones appear to be transparent to the X-light; those containing calcium carbonate are much more likely to throw a shadow on the plate. The proper position in which to place the patient who is being radiographed for gall-stone is face downward upon the plate, the body being bent backward by placing supports under the thorax and pelvis, while the tube is placed a little to the right of the median line opposite a point a little below the level of the free border of the liver.

Treatment. Surgery has a distinct place in the treatment of gall-stones but the treatment of gall-stone disease may with truth be said to be entirely medical. Operative measures are adapted only to gall-stones of gall-bladder origin and then only under conditions which demand mechanical relief. Upon consideration of *post mortem* records it is seen that from 6 to 10 percent. of all cadavers show the presence of biliary calculi and when it is shown that not more than 1 person in 20 of those who harbor gall-stones becomes aware of their presence as evidenced by symptoms, in many instances insufficient to require operation, it is readily demonstrable that the field of surgery is decidedly limited, although of great importance in selected patients. Keeping these facts in mind, and remembering the distinction between gall-stone disease and gall-stones, more will be expected of the internalist and fewer disappointments will be attributed to the failure of surgery.

The treatment of the microbic causes of biliary calculi is that of the responsible infection itself and the limitation of opportunities for entrance of the infectious agent. The management of the congestive disorders referable to the heart, lungs, etc., which predispose to the formation of gall-stones and that of the mechanical conditions, such as pregnancy and visceral displacements, need not be dealt with here. The proper treatment of the foregoing states will accomplish much in the prophylaxis of gall-stone disease.

Aside from the measures indicated in the relief of an acute attack of biliary colic the treatment should be based upon the general conditions mentioned in the immediately preceding paragraph. The administration of olive oil by the mouth for the acute paroxysm and for the other phases of the disease, even in those instances in which it is tolerated in sufficiently large amounts and for long periods of time, has utterly failed to produce even relief. Operative procedures during an attack, theoretically so clearly indicated for an impending suppurative cholecystitis, have almost uniformly resulted in death so far as the author's observation goes.

It has become apparent that the important feature of the treatment of gall-stone disease is the regulation of congestions and inflammations in the portal system and dependent organs, and in local antiseptics. The spa treatment appeals to many. Success is based upon the fact that at the resort the patient's habits of life are regulated, the diet is controlled and the use of the salines diminishes congestions and inflammations in the portal area. Of these Neuenahr, Kissingen, Vichy, in Europe, Bedford, Sharon and Las Vegas in the United States, are preferred. Carlsbad has the advantages of many and varied attractions but on account of these it is difficult to induce patients to steadfastly and seriously attend to the business of getting well; because of this fact, even though the waters of this resort are preferable to those of many others, a sojourn at this spa is often of little benefit.

Within recent years it has become possible to obtain practically as good results at home as at the water cures by means of the subjoined régime honestly followed: 1. *Diet:* This should be mixed, for vegetable food produces a smaller amount of bile acids, and saccharine or fatty foods give rise to intestinal fermentation. The meals should be limited in amount, taken at frequent intervals to ensure constant flow of bile, with plenty of plain or feebly mineralized water before each repast. Alcohol is prohibited. 2. *Exercise,* especially in the open air, is important. 3. *Cholagogues:* With the exception of salicylic acid and certain salts, of bile itself and especially of salts of the bile acids, it is doubtful if the drugs usually so designated are more than temporarily effective. As for salicylic acid there is no doubt as to its cholagogue properties, that it is excreted in the bile and thus disinfects the bile passages. No advantage is possessed by sodium salicylate given in conjunction with sodium bicarbonate or sodium benzoate. Salicylic acid is pref-

erable not only on account of its cholagogue properties but because it is a biliary and intestinal disinfectant as well (which the salicylates are not) and thus diminishes intestinal catarrh. The bile acids in intestinal putrefaction are believed to be chemical antiseptics, physiological cholagogues and fat emulsifiers. In hepatic insufficiency they render the bile less viscid and cause an increase of normal bile acids; in gall-stone they may be preventive and, by causing a copious outpouring of thin bile, may to some extent, prevent bacterial invasion of the gall-bladder and hepatic duct and at the same time, favor drainage of the bile channels. The use of bile acids and their salts is more scientific than the administration of bile itself because they are the physiologically active principle of this substance, and any danger from the introduction of poisonous bodies from the bile, which really is an excretion, is thus avoided. Of all the preparations sodium glycocholate, in ½ to 3 grain (0.032 to 0.2) doses as frequently as is necessary, is the best. Both bile and its salts are, however, uncertain in action.

Acid sodium oleate, like salicylic acid, is excreted by the epithelium of the bile ducts and so assists in disinfection. Phenolphthalein, although a phenol derivative, does not dissociate in the intestine to any appreciable extent; this drug continues its antiseptic effect through the length of the intestinal tract. If the acid sodium oleate is carefully prepared and is combined in a pill with salicylic acid obtained from natural sources, 1½ grains (0.1), phenolphthalein 1 grain (0.065), and menthol, which is a carminative, acts as an intestinal antiseptic, increases peristalsis and allays nausea, ¼ grain (0.016) we possess a very efficient means of combating gall-stone disease. This combination is best prescribed, on account of the difficulty of obtaining the proper sodium oleate and of manufacture, as probilin pills; 4 to 8 pills should be taken daily in a full glass of hot water. Following this medication the elimination of gall-stones of the hepatic variety is generally rapid. That the process may be painless is best achieved by the administration of amyl valerate, 15 minims (1.0) in capsule two hours before breakfast and after supper.

In the treatment of gall-stone disease we should consider that we are confronted by an affection which is not purely due to the presence of a foreign body but which is primarily a hepatic disorder. The removal of the calculi is of little moment for even when this has been accomplished by surgical means the patient is but at the commencement of his treatment, the object of which is to remove the cause of the disease, a problem which is purely medical. The congestions and inflammations in the portal area require treatment and the correction of these and of the infectious catarrhs of the bile ducts and gall-bladder and of the faulty bile formation in the liver is a matter which is distinctly within the province of the physician.

Biliary colic with its agonizing pain often needs the hypodermatic administration of morphine for its relief; the patient may be kept lightly under the

influence of chloroform given by inhalation until the effect of the morphine is evident. Amyl valerate in 15 minim (1.0) capsules repeated every 4 or 5 hours may prove effective and should always be given in preference to any opium derivative. It should be hardly necessary to state that the hypodermic syringe should never be given to a patient. Antipyrine given early in the paroxysm may prove useful and hot applications to the hepatic region and hot baths are sometimes efficient in aiding the relief of the pain. Gastric lavage has been suggested and may assist in the control of the nausea and vomiting; these latter, however, usually stop with the cessation of the colic. In mild attacks 8 minims (0.5) of tincture of belladonna in a drachm (4.0) of spirit of chloroform may lessen the pain.

The surgical treatment of gall-stones, as previously asserted, should be confined to those instances of the disease in which mechanical removal of the foreign body is necessary, the procedure in each case being adapted to the patient in hand. It is difficult to see how operation can do more than relieve the condition present at the time of the undertaking for even removal of the gall-bladder *in toto* can hardly prevent the further formation of calculi in the bile ducts.

Ulceration of a gall-stone through the wall of the bladder or of the bile ducts with acute symptoms such as those of peritonitis, of course, demands immediate laparotomy.

NEOPLASMS OF THE GALL-BLADDER.

Cancer of the gall-bladder is infrequent; columnar or spheroidal-celled carcinoma is the usual type. It is more frequent in men than in women and is more often primary, the fundus being first involved. Secondary carcinoma which has spread from growths of adjacent organs by contiguity has been observed and involvement of neighboring structures in primary cancer of the gall-bladder also occurs. In a very large majority of primary cancers gall-stones are present, the latter being considered as cause of the former, probably as a result of irritation; the calculi have also been held to be a result of the neoplasm, the growth causing changes in the bile which favor their formation.

Symptoms. Jaundice occurs with involvement of the common or the cystic duct but not unless these structures are affected. Other symptoms are nausea and vomiting, hæmatemesis, melæna, pain and œdema due to pressure. The pain is often paroxysmal and tenderness is frequently associated with it. Cancerous cachexia may supervene.

A dense and hard tumor is palpable in the region of the gall-bladder and when large, as often occurs as a result of dilatation of the organ or involvement of neighboring structures in the growth, extends downward and toward the mid-line of the abdomen.

Treatment. Medical treatment is palliative only. The pain may be

relieved by morphine or other less potent analgesics; the nausea and vomiting may be controlled by gastric sedatives such as menthol, cerium oxalate, dilute hydrocyanic acid, etc.; the bowels should be kept open by means of mild laxatives and if intestinal fermentation exists the usual means should be employed in its relief.

In order to be curative operation should be undertaken as early as possible and before there is cancerous involvement of other organs. Post-operative hæmorrhage is frequent and is often responsible for death, consequently surgical measures should be preceded for 2 or 3 days by the administration of calcium lactate or chloride 20 grains (1.33) 3 times daily.

NEOPLASMS OF THE GALL DUCTS.

As is the case with malignant tumor of the gall-bladder, carcinoma is the only type of growth which affects the gall ducts. The condition is rare and may be either primary or secondary. In the latter instance the primary tumor is usually in the gall-bladder or in the liver itself. Jaundice is an early symptom; it is persistent and usually extreme; the development of cachexia is rapid. The gall-bladder is enlarged and may rupture. Pain and tenderness are generally present. The diagnosis is difficult and often impossible without exploratory incision. Gall-stones may be present, as in carcinoma of the gall-bladder, and, as in this condition, have been held to be both the cause and the result of the cancerous growth.

Treatment. The medical treatment is identical with that of carcinoma of the gall-bladder. The itching, which is frequently associated with the intense jaundice, may be relieved by weak phenol lotions or by means of a powder composed of an ounce (30.0) of starch, a half ounce (15.0) of zinc oxide and 1½ drachms (6.0) of camphor.

Operative treatment is difficult but it may be possible to remove the seat of the disease in certain instances; recurrence after operation is not infrequent. Carcinoma of the ampulla of Vater and of the duodenal papilla has been removed, the divided end of the common duct being implanted into a healthy part of the duodenum.

STENOSIS OF THE GALL DUCTS.

Occlusion of the gall ducts may result from cicatrization of an ulcer due to a calculus; syphilis may be a cause in some instances; foreign bodies may also reach the ducts through the duodenum and cause obstruction. Occlusion due to the presence of the *ascaris lumbricoides*, to the echinococcus or to liver flukes may occur but is rare. Obstruction also may follow pressure from without which may be due to enlarged lymph glands at the hilum of the liver or to tumors of neighboring parts. *Congenital obliteration* of the gall ducts has been observed and is always fatal.

Symptoms. There is early enlargement of the liver with the symptoms of obstructive jaundice. Later the liver may become small and is usually found to be cirrhotic. Complete permanent occlusion is fatal either from the condition itself or from the causative lesion. Patients with partial stenosis may live, continuously jaundiced, for years.

In congenital obliteration hæmorrhages, especially from the umbilicus, are prone to occur. There is increase of the interstitial connective tissue of the liver and the spleen is increased in size.

Treatment. If there is a syphilitic element in the condition appropriate medical treatment should be prescribed. If no result is obtained operation with a view of making an anastomosis between the gall-bladder and the intestine, if the obstruction is in the common duct, should be undertaken.

PARASITES OF THE GALL DUCTS.

As previously stated round worms may find their way into the bile passages and cause obstructive jaundice. The diagnosis of the condition can be made only by finding worms or their ova in the stools. Infectious micro-organisms may be carried with the worms into the ducts and cause suppurative inflammation with its attendant symptoms.

The treatment of the condition is that of ascariasis (see the section upon parasites), unless suppuration has supervened, when the indications should be met as in similar infective processes from other causes.

Hydatid cysts, due to lodgment of the echinococcus in the ducts, may develop and cause obstruction, or the tumors in the substance of the liver may press upon the passages from without with similar result.

Other parasites which have found harbor in the gall ducts of man are the *distoma hepaticum*, the *coccidium oviforme*, the *pentastoma constrictum* and the *balantidium coli*. The diagnosis is well-nigh impossible although the ova of the *distoma* have been demonstrated in the fæces; the symptoms are those of bile duct obstruction due to more usual causes.

The treatment is also baffling, save in the obstruction due to the distoma, when anthelmintics are indicated. Surgical treatment becomes necessary if symptoms of suppuration supervene.

DISEASES OF THE PANCREAS

ACUTE PANCREATITIS.

Definition. An acute inflammation of the tissues of the pancreas occurring in three types, (a) hæmorrhagic; (b) suppurative; (c) gangrenous, which, although they often possess an intimate relation to one another, will be considered separately.

ACUTE HÆMORRHAGIC PANCREATITIS.

Ætiology. This, like other inflammations of the pancreas, is a rare affection. It is observed most frequently in adult males; alcohol seems to be a factor in its incidence; it also occurs in patients who have suffered from severe gastric symptoms and gall-stone disease. Parturition is mentioned as a cause, the pancreas being either affected in a way similar to that met in the kidneys and liver in the toxæmias of pregnancy or by embolism of giant cells from the placenta. Traumatism has been held responsible in some instances.

Pathology. The pancreas is the seat of a general enlargement and is infiltrated with blood which is sometimes present in clots. Gall-stones may be found in the bile ducts. The cells of the organ may have undergone a coagulation necrosis and at the borders of these necrotic areas the products of exudative inflammation, fibrin, red and white blood cells, are found. Foci of fat necrosis, white in color, may be observed in the lobules of the pancreas and in the omentum and mesentery. Bacteria may be present.

Symptoms. The onset is characteristically sudden with severe abdominal colic; this may be localized in the upper abdomen or general; there are nausea and vomiting and symptoms of collapse depending in type upon the severity of the attack. The pain and collapse are attributed to a stretching of the cœliac plexus due to the suddenly appearing swelling. The abdomen becomes swollen, tympanitic, and tender, and palpation of the epigastrium may reveal a sense of resistance. At the invasion a chill may occur to be followed by moderate fever.

The diagnosis is not easy. Intestinal obstruction may be very difficult of differentiation, but sudden severe pain in the upper abdomen, accompanied by tenderness and later a sense of resistance, with vomiting, collapse and slight fever, is suggestive of pancreatic lesion. According to Fitz, scattered areas of abdominal tenderness and tenderness over the pancreatic region are valuable signs.

The prognosis is distinctly unfavorable although recovery has been observed in rare instances. Death usually takes place in from three to seven days or, if life is prolonged, gangrenous pancreatitis may follow.

Treatment consists in the employment of means to lessen the pain, such as hot applications to the abdomen and the hypodermatic administration of morphine. The symptoms of collapse should be combated by means of entero- or hypodermatoclyses of hot normal saline solution and hypodermatic stimulation.

ACUTE SUPPURATIVE PANCREATITIS.

Synonym. Pancreatic Abscess.

Ætiology. The causation of this condition is indefinite; traumatism and digestive disturbances due to dietetic errors have been considered as ætiolog-

ical factors. The infection reaches the organ through its ducts or by extension from some adjacent suppurative focus. Pancreatic suppuration may also result from purulent cholangitis which has spread to the organ through its duct.

Pathology. The pancreas is enlarged and contains one large abscess or a number of smaller ones; in other instances a diffuse purulent infiltration has been observed. Extension of the inflammation into the tissues surrounding the pancreas may occur or rupture into neighboring structures, peritonæum, stomach, etc., may take place. Thrombosis of the portal and splenic veins has been described. Fat necrosis is unusual.

Symptoms. In acute instances the onset is sudden with epigastric pain, vomiting and a pyæmic temperature with rigors and sweats. The abdomen is tense and tympanitic and the spleen may be enlarged. There may be fatty diarrhœa, glycosuria and jaundice. The patient is markedly prostrated and death often takes place within a week. At other times the course is more prolonged, emaciation is marked and progressive, and rupture of the pus-containing cavity, with accompanying symptoms may occur.

The diagnosis is very difficult; the existence of a tender mass in the epigastrium with fatty diarrhœa and sugar in the urine should be of great aid in differentiation.

The prognosis is unfavorable but recovery after operation has been observed.

Treatment aside from symptomatic and supportive measures is essentially surgical.

ACUTE GANGRENOUS PANCREATITIS.

Ætiology. This affection is usually a sequela of pancreatic hæmorrhage. It may follow perforative ulcer of the stomach, intestine or biliary tract or even extension through the pancreatic duct of a cholangitis. Traumatism is also an ætiological factor.

Pathology. The pancreas is usually changed into a dark slate-colored mass, soft and putrid, and is surrounded by a thin greenish or dark-colored purulent fluid; it may lie nearly free in the cavity of the omentum or in an abscess cavity which is plainly palpable externally. In other instances the organ is dry and necrotic. Scattered areas of fat necrosis are frequent.

Symptoms. These are usually those of acute hæmorrhagic pancreatitis followed after a few days by fever, chills, abdominal distention with tenderness and jaundice. Death in collapse takes place in a few days to two or three weeks. Recovery has followed the discharge through the rectum of the necrotic organ.

Treatment is symptomatic and supportive. Operation, if indicated, may be undertaken.

CHRONIC PANCREATITIS.

Ætiology. Chronic inflammation of the pancreas may follow acute pancreatitis or catarrhal inflammation of the duct of Wirsung which has resulted from a chronic gastro-duodenitis. Gall-stone disease is, however, responsible for a large proportion of instances and consequently the causation of these is that of the primary cholelithiasis (see the section upon this subject). Chronic pancreatitis may also arise by extension of neighboring inflammations. Syphilis may be mentioned as a cause.

Pathology. The organ may be increased in size. Two types of chronic pancreatic inflammation are described the *interlobular* and the *interacinar*. The former is less diffuse than the latter and does not interfere by its new growth of connective tissue with the functions of the islands of Langerhans. Inter-acinar inflammation invades these structures and may result in their obliteration. The changes in the two forms of the affection are comparable to those occurring in the liver in hypertrophic and atrophic cirrhosis, the distinctive feature being an increased production of connective tissue which may be more or less localized in one part of the organ.

Symptoms. These are not characteristic.

The patient may suffer for years from digestive disorders with intermittent diarrhœa. Later jaundice and ascites may occur with paroxysmal pain felt deep in the epigastric region. Faintness and gradual emaciation may be present. The presence of glucose and fat may be demonstrated in the urine and fat may appear in the stools. If there is organic change in the pancreas, which permanently interferes with the functions of the islands of Langerhans, the glycosuria is likely to be permanent (diabetes mellitus). Should there be only temporary glycosuria the probability is that the affection of the islands is merely functional.

Upon palpation a circumscribed resistance over the pancreatic region may be detected and in rare instances the organ itself or its head may be distinctly palpable.

The prognosis as to cure is unfavorable but there may be advanced disease of the organ without great interference with general health.

Treatment. The similarity in the causation between this and gall-stone disease is marked, consequently we could hardly do better than to prescribe an analogous method of treatment. The dietetic and hygienic methods suggested for cholelithiasis are applicable here and the administration of such a pill as that mentioned on p. 480 and composed of 1½ grains (0.1) each of acid sodium oleate and salicylic acid, 1 grain (0.065) of phenolphthalein and ¼ grain (0.016) of menthol, in the same fashion as there described, is recommended.

It has been suggested that, since fats and sugars need the pancreatic secre-

tion for their digestion, foods of these classes be restricted, or if allowed, that pancreatin in doses of from 5 to 10 grains (0.33 to 0.66) be given. Diastase and pancreatic substance chopped fine may also be given as an aid to their digestion.

Accompanying biliary obstruction due to stone or other causes may necessitate appropriate surgical measures.

TUMORS OF THE PANCREAS.

Pancreatic tumors occur as cancer (carcinoma, more rarely adenoma, sarcoma or lymphoma), as non-malignant cystic growths, or as syphilitic gummata.

Cancer of the Pancreas.

As previously stated the most common malignant growth affecting the pancreas is the carcinoma; it may be of either scirrhous or colloid type. Primary tumors are usually situated in the head of the gland but the involvement may be confined to any part of the organ. Secondary carcinoma may spread to the pancreas from similar growths in contiguous structures. Like other malignant tumors, cancer of the pancreas is usually observed in individuals beyond middle age.

Symptoms. The condition is difficult of recognition; of the usual symptoms the following are most important. Paroxysmal pain in the epigastrium with gastric irritability; jaundice (when the growth is in the head of the organ) due to pressure upon and obstruction of the common bile duct; this icterus may be extreme and associated with bile-stained urine, light colored stools, dilatation of the gall-bladder, fatty stools and glycosuria which last, however, are by no means constant; emaciation with steadily increasing cachexia; the presence of an immovable tumor in the epigastrium, which may not be palpable unless the patient is subjected to anæsthesia. In thin patients the pulsation of the aorta transmitted through the overlying tumor may be appreciated.

The diagnosis. The distinctive features of the affection are the jaundice and the presence of an immovable tumor with rapid emaciation. Cancer of the pylorus is not associated with icterus, except in rare instances, and is usually movable, the results of gastric analysis are characteristic and there is consequent dilatation of the stomach. Carcinoma of the colon may be movable and there is no icterus in this condition; intestinal obstruction occurs in the late stages.

The prognosis is unfavorable unless the diseased portion of the gland can be removed.

Treatment from a medical standpoint is symptomatic and supportive only. Surgical removal of the disease has resulted in cure in a number of instances.

Cysts of the Pancreas.

Ætiology. Retention cysts of the pancreas result from occlusion of the ducts of the organ due to compression. The pressure may be exerted by influences within or without the substance of the gland. Traumatism or prolonged pressure is responsible in certain instances. Obstruction occurs as a result of the impaction of gall-stones or pancreatic calculi, of the contraction of newly produced connective tissue (sclerosis), of inflammations of the lining of the pancreatic ducts occurring as a result of the extension of catarrhal processes in the duodenal mucous membrane and of displacements of the organ causing a kink in its duct.

Adults are more frequently affected with cystic conditions of the pancreas but the affection has been observed in children.

Pathology. The cysts vary much in size and may be single or multiple; single cysts containing several gallons of fluid have been found. In the early stages the contents is normal pancreatic juice, later it becomes dark in color and may contain albumin and blood. The reaction is alkaline and the specific gravity from 1,010 to 1,025. The characteristic pancreatic ferment may be present. Under the microscope, in addition to red and white blood cells, oil droplets and degenerated epithelial cells, fatty acid and cholesterin crystals may be found.

Symptoms. There may be colicky abdominal pain with nausea and vomiting or these symptoms may be wholly absent; the patient may perceive nothing unusual until the increasing size of the abdomen comes before his notice. Jaundice and ascites, due to pressure upon the bile ducts and portal vessels, may be present with large cysts. Fatty diarrhœa and pancreatic salivation are rare; glycosuria may be present. Disappearance of the cyst and its symptoms may take place suddenly, due to temporary relief of the obstruction.

The diagnosis depends upon the result of physical examination. In typical instances the tumor lies in the mid-line of the upper abdomen; in those of extreme type the cyst may fill almost the entire abdominal cavity. It is seldom mobile and does not descend with inspiration; its surface is smooth or lobulated and it is elastic in consistency. The stomach may be demonstrated above and the colon below the tumor. Percussion reveals the presence of a flatness which is not continuous with the dull note elicited over the liver or spleen. Fluid aspirated from the cyst should digest albumin and emulsify fat, but the former characteristic only, is pathognomonic, for numerous exudates and transudates contain fat-emulsifying ferments.

The prognosis under proper treatment is good.

Treatment is exclusively surgical and consists of incision and drainage. Extirpation of the cyst has been followed by diabetes mellitus.

PANCREATIC CALCULI.

Ætiology. Pancreatic lithiasis is a rare condition. The stone is probably the result of inflammation of the pancreatic duct with resulting abnormality in the composition of the secretion and ultimate precipitation.

Pathology. The calculi are whitish in color and often multiple; in size they vary from that of a grain of sand to that of a good sized pea. They may be rounded and smooth or irregular and rough. They are composed chiefly of calcium carbonate, sometimes with the addition of calcium phosphate. The irritation caused by their presence may result in inflammation of the pancreas, with dilatations of the duct or even of the gland itself, suppurative inflammation of the organ or even cancer.

Symptoms. The colic due to passage of the stone into the duodenum is very like that due to gall-stones and it is practically impossible to differentiate the two conditions, particularly since jaundice may be a feature of both. Glycosuria and fatty diarrhœa with colic in the upper abdomen may give the clue to the diagnosis of pancreatic stone. If calculi composed of calcium carbonate are found in the fæces the diagnosis is assured.

The prognosis depends upon the development of sequelæ such as chronic pancreatitis, suppuration or cancer.

Treatment. The attacks of colic should be controlled by the means suggested for the relief of biliary colic (q.v.). Disturbances of digestion should receive appropriate treatment and one instance has been reported where the administration of 8 to 15 minims (0.5 to 1.0) of a 1 percent. solution of pilocarpine three times a week, with the object of increasing the pancreatic secretion, was successful in checking the attacks. Hydrochloric acid is also said to promote the flow of pancreatic juice and its employment is worthy of trial.

DISEASES OF THE PERITONÆUM.

ACUTE PERITONITIS.

Definition. An acute inflammation of the peritonæum.

Ætiology. *Primary* acute inflammation of the peritonæal membrane is a very rare affection but is said to occur as a result of exposure to cold and wet and has been termed *rheumatic* or *idiopathic* peritonitis.

Secondary peritonitis is frequent and is due to the extension of an inflammation of any of the structures adjacent to the peritonæal membrane, to rupture

of any of the viscera which the membrane surrounds or to abdominal operations which have been performed without due regard to perfect asepsis.

Of peritonitis caused by extension, inflammations or tumors of any of the following organs or structures may be at fault; the stomach, the intestines, the liver, the gall-bladder, the spleen, the pancreas, the organs of either the male or female genito-urinary system. Abscess of the peri-renal tissue, of the spine, as in Pott's disease, or the cold psoas abscess may cause peritonitis by rupture or by extension.

Peritonitis also may follow rupture of any of the viscera named above but the most important causes of perforative peritonitis are appendicitis and rupture of suppurative processes involving the structures about the ovaries and Fallopian tubes. In considering the ætiology of peritonitis, perforation of the viscera resulting from external wounds must not be forgotten.

Peritonitis also occurs as a complication of acute polyarthritis and pleuritic inflammations and sometimes as a terminal infection in chronic nephritis, arteriosclerosis and gouty conditions

Secondary peritonitis is without exception of microbic origin and the causative bacteria are either those responsible for the primary inflammation or those introduced into the peritonæal cavity with the contents of the ruptured viscus; the most usually found organisms are *staphylococci pyogenes aurei* or *albi*, *streptococci* and *bacilli coli communes*. Less commonly found are the tubercle bacillus, the bacillus of enteric fever, the pneumococcus, the bacillus of epidemic influenza, the bacillus pyocyaneus, the bacillus ærogenes capsulatus, the bacillus proteus and the gonococcus. The amœba coli has been found in peritonitis occurring with tropical dysentery. In some instances the infection may be due to a single type of micro-organism but much more frequently cultures from the inflammatory exudate will show a mixed infection. The mono-infections occur more especially in peritonitis secondary to or accompanying nephritis as a terminal infection, acute rheumatism, gout, arteriosclerosis and pleurisy.

Pathology. The intestines are distended with gas and their peritonæal surface is congested; the coils of gut are more or less adherent to one another due to an exudation of lymph-like substance which is made up of fibrin and white blood cells. The inflammatory exudate upon the surface of the peritonæum or into its cavity may be of fibrin only, of serum with fibrin, of pus, creamy or greenish in color, or of bloody serum, especially in instances due to external wound. In early stages, before the appearance of fluid, the peritonæum is slightly roughened and its lustre is dulled. Foul fluid mixed with intestinal contents is present in peritonitis due to perforation of the intestine, and after rupture of the uterus occurring in puerperal or carcinomatous conditions, a fœtid, grayish-green exudation is often observed. The amount of fluid present varies from a small quantity to 20 quarts (litres) or more.

In instances of long standing the lymph adhesions between the coils of intestine and other viscera become organized and may finally result in the formation of dense bands of tissue. In circumscribed peritonitis these are especially noticeable and the adhesions may wall off localized collections of pus or abscesses which may rupture, which event is followed by a general peritonæal inflammation.

Symptoms. *Acute generalized peritonitis* when due to perforation is sudden in its onset and characterized, in very acute instances, by a fall of temperature and evidences of collapse, such as great prostration, cold perspiration and rapid, small and weak pulse; there is abdominal pain with general tenderness. The respirations are shallow, rapid and thoracic rather than abdominal. After the chill of the invasion there may be moderate fever, rarely is the temperature high, and it may remain normal or even below this point. The urine is scanty and may contain indican. The pain is often severe and is greatly increased by motion but at times the patient, if he is allowed to lie quietly in the position which he chooses—usually with the thighs flexed and the shoulders raised so as to relax the abdominal muscles—makes little complaint. The abdominal wall is tense and hard and upon examination tenderness and a tympanitic percussion note are observed. The tongue is moist at first; later it becomes dry and cracked. Vomiting is early, frequent and very painful; the vomitus consists of stomach contents, followed by thin bile-stained fluid and ultimately by dark liquid, sometimes of fæcal odor. The bowels are often loose at first but constipation soon supervenes.

Physical examination, in addition to the signs already mentioned, reveals a typical facies—the Hippocratic countenance—the eyes, cheeks and temples being sunken, the nose pinched, the lobes of the ears turned out, the forehead rough and dry and the skin dark or livid. The abdomen is tympanitic, the diaphragm and the cardiac apex may be displaced upward and both liver (Clark's sign) and splenic dulness may be obscured or even obliterated. These manifestations are particularly marked if air, as well as fluid, is present in the peritonæum; this takes place when the perforation involves an air-containing viscus. If the patient lives long enough, fluid, with its characteristic signs, appears in the peritonæum. It is evidenced by increasing dulness in the flanks, the extent of which is altered by a change in the position of the patient. There may, however, be a considerable effusion without movable dulness; a peritonæal friction sound may be detected. In determining the presence of pneumoperitonitis one must remember that in this condition hepatic dulness, even in the mid-axillary line when the patient is on his left side, may be absent, while when fluid alone is present liver dulness exists under these circumstances although it may be absent when he lies flat on his back.

The mental condition usually remains clear until near the termination of the disease when coma or delirium may supervene. As the end approaches

the pulse becomes feebler and feebler, irregular and intermittent, the temperature rises, although the skin may remain cold, and death occurs. In the fulminating type of peritonitis this event may take place within two days, in less severe infections the course may be prolonged for a week or more. At times sudden death occurs, due probably to cardiac paralysis.

Acute localized peritonitis is characterized by symptoms analogous to those of general peritonitis but they are much less severe and are usually associated with those of the primary disease to which the peritonæal inflammation is due. The onset of the symptoms is slower, those of the peritonitis being gradually engrafted upon those of the causative lesion. The pain is less marked and more distinctly localized, and the same is true of the tenderness; vomiting may also be present. There is progressive weakness but the course of the affection is longer, the temperature is more generally elevated and is likely to be of septic type. The evolution of the disease is less rapid and recovery is much more frequent than in general infection of the peritonæum.

The most frequent situations of localized peritonitis are in the neighborhood of the appendix, as a result of inflammations of this structure, and in the pelvis where infective conditions of the female generative organs are responsible. Subdiaphragmatic abscesses involving the peritonæum between the upper abdominal viscera and the diaphragm are a not unusual form of circumscribed peritonæal inflammation.

The diagnosis of *general peritonitis* with the typical sudden onset, tenderness, distention, collapse, etc., is not difficult especially if there is a history of possibly causative lesion such as that of repeated attacks of appendiceal pain or of ovarian or tubal disorders. In enteric fever the diagnosis of perforative peritonitis may be obscured by the fact that abdominal tenderness and distention are not unusual symptoms of the uncomplicated disease, but the sudden appearance of pain, tenderness, abdominal rigidity, fall in temperature and collapse in a conscious patient is a very reliable index of this serious complication.

The most important conditions to be differentiated from general peritonitis are:

1. *Hysterical peritonitis.* This is observed in women and is a most baffling condition. It simulates every detail of true peritonitis almost exactly, even to the collapse and temperature. The patient, however, does not die and the accompanying hysterical manifestations are likely to give the clue to the diagnosis.

2. *Intestinal obstruction* is also difficult of separation, but the history of the patient usually affords help.

3. *Ruptured ectopic pregnancy* is accompanied by many of the symptoms of peritonitis, but here also, the history aids in differentiation.

4. *Rupture of abdominal aneurysm, embolism of the mesenteric vessels,*

acute entero-colitis and *hæmorrhagic pancreatitis* are other possibilities which must be excluded in the differential diagnosis of acute peritonitis.

The diagnosis of *localized peritonitis* is greatly facilitated by the history of a causative lesion. If the collection of pus is near the skin it may be possible to detect the presence of fluctuation and in some instances the aspirator may be employed to advantage.

The prognosis of general peritonitis is distinctly unfavorable unless immediate operative interference is undertaken; the earlier the peritonæal cavity is opened and drained the better are the chances of recovery, a fact which should emphasize the importance of early diagnosis. The same is true of localized acute peritonitis although spontaneous cure following external rupture has been observed.

Treatment. Much can be done in the way of preventing puerperal and post-operative peritonitis by proper attention to asepsis and antisepsis in surgery and midwifery.

When there is any possibility of the occurrence of perforative peritonitis, or this or any other type of the infection has occurred, the patient should be kept absolutely at rest; if the patient is unwilling to lie quietly the importance of implicit obedience to the physician's orders should be explained and if he is still obstreperous he should be restrained; usually, however, the sufferer from peritonitis is quite willing to lie still on account of the increased pain which movement induces. Passive movements for purposes of physical examination are justifiable but should be as limited as possible. It has been suggested that the best position in which the patient can lie is one in which the lumbar portion of the abdominal cavity is lowest in order that the infectious exudate may be prevented from reaching the pelvic peritonæum and that of the subphrenic region. This object may be accomplished by raising the foot of the bed and by propping the patient's shoulders by means of pillows.

The prevention of possible perforative peritonitis by means of excision of gastric ulcers is a surgical measure that has received much attention of late.

Peristalsis should be prevented, for by this action of the intestinal musculature the dissemination of infectious matter through the peritonæal cavity is favored and the formation of adhesions which may wall off the inflammation may be interfered with; consequently all influences which cause peristalsis should be avoided and it has been advised to allow nothing by mouth, not even water for two or three days after the onset of the peritonitis. Thirst may be relieved by permitting the patient to dissolve bits of ice in the mouth, but the resulting water must not be swallowed; stimulation may be given and water provided to the tissues by frequent small enemata of saline solution provided this measure does not increase the patient's discomfort too much.

Hypodermatoclysis of salt solution—a quart (litre) or more given twice a day—is an excellent and effective measure. When the necessity for food

has become urgent, this must be given by the rectum; hypodermatic injections of oil are also useful in this connection.

The pain may be relieved by the application of the ice coil, hot compresses or turpentine stupes made with ice water. Local applications should always be of as light weight as possible for obvious reasons.

Opium and morphine do not influence the disease itself to the least degree but are useful in the control of the pain, restlessness and vomiting. These drugs, especially the latter, also lessen peristaltic action and are of additional benefit for this reason. Morphine administered hypodermatically is usually preferable to opium by mouth or rectum. The abdominal distention is an obstinate symptom but may yield to the usual symptomatic measures; the introduction of the rectal tube and high enemata are, however, not advisable. Hiccough, which is not infrequently a distressing symptom, may be relieved by atropine or morphine given under the skin.

Heart weakness and tendency to collapse necessitate free hypodermatic stimulation by means of strychnine, alcohol, æther and other quickly acting drugs; digitalis is especially indicated in the slow, weak pulse of low tension, but its action is too slow for use in a condition where immediate results are desired. Hypodermatoclysis of hot normal saline solution is an excellent means of combating collapse and the hypodermatic use of adrenalin in doses of 20 to 30 minims (1.33 to 2.0) of the 1 to 1,000 solution has been recommended. Hot baths at 104° F. (40° C.) are said to be an efficient method of tiding over an attack of collapse.

Medical treatment in general peritonitis is at best unsatisfactory and ineffectual, except in so far as by its employment we are enabled to relieve the distress of a dying patient. The only truly curative treatment of this disease is immediate opening of the abdominal cavity and the establishment of proper drainage. The conditions found upon operation necessitate the adaptation of the details of the procedure to the case in hand. It is generally conceded that radical surgical measures should be undertaken as soon as the diagnosis is established and certain conservative surgeons are advocating operation as a preventive measure, as for instance in the presence of gastric ulcer with localized peritonitis and imminent rupture.

The treatment of localized exudative processes in the peritonæum is also, in the main, operative. It may be possible to relieve the symptoms by such local applications as those suggested in a previous paragraph but in general it may be safely stated that the sooner the patient is placed in the hands of a skilful surgeon or gynæcologist the better are the opportunities for recovery.

CHRONIC PERITONITIS.

This type of peritonæal inflammation, like the preceding, may be either local or general.

Local or *circumscribed peritonitis* of chronic course may result from the extension of inflammations of the organs involved by the peritonæum. It is especially common in the regions of the liver, spleen and diaphragm and is characterized by adhesions between these structures; it is also frequent in the pelvis. The peritonæal adhesions which so frequently follow intra-abdominal surgical operations must be considered as a variety of this affection. External traumatism is likewise an ætiological factor.

Pathology. Fibrous adhesions occur between the coils of intestine, the peritonæum and the diaphragm, the pelvic portion of this membrane and the near-by structures. Areas of thickening or contraction of the peritonæum may be observed.

Symptoms. Marked adhesions may occur which never give rise to suspicion of their presence. In other instances there may be colicky pain in the abdomen due to a stretching of the adhesions by peristalsis; constipation is often present and vague abdominal discomfort is common. Contraction of the fibrous bands or entanglement of the intestine in one of these may result in obstruction of the bowel with its attendant symptoms. A peritonæal fremitus may be palpable.

Treatment. The abdominal discomfort may be relieved by wearing a properly fitting belt or binder in some instances. Internal medication can have no effect upon the adhesions but inunctions of 10 percent. iodine in vasogen may possibly result in a tendency to absorption of the newly produced tissue. If the symptoms are sufficiently severe, radical surgical measures may be undertaken with the object of breaking up the adhesions, but the possibility of their reformation must not be forgotten.

Chronic diffuse peritonitis may occur secondarily to mild acute general peritonitis, in association with the venous congestion caused by chronic disease of the heart or liver, as a result of repeated abdominal paracentesis for ascitic conditions or following external trauma. The marked proliferative thickenings of the peritonæum which are sometimes accompanied by similar conditions of the pleura and pericardium (*panserositis*) are to be considered as a type of this variety of peritonitis.

Pathology. The condition of the peritonæum is in some respects similar to that obtaining in tuberculosis and cancer of this membrane. There is an extreme degree of thickening and the intestines may be firmly adherent to themselves or neighboring structures; at other times the thickening is the most salient lesion, few or slight adhesions being present. The peritonæum is whitish in color and non-transparent; the thickening is frequently much more marked in certain places than in others and the liver and spleen are often surrounded by a firm tough layer of fibrous tissue which by its shrinkage may have caused considerable decrease in their size. Thickening and shrinkage of the mesentery and omentum are present and the portal vein may be

constricted. A serous effusion is frequently observed and adhesions may separate the general cavity into several smaller ones each of which may contain fluid. Nodules, resembling tuberculous deposits, may be found.

Chronic diffuse peritonitis with a hæmorrhagic effusion occurs in cancerous and tuberculous disease and also as a condition similar to hæmorrhagic cerebral pachymeningitis. This type of the affection is usually confined to the pelvis, the hæmorrhage being due to rupture of new vessels formed in the peritonæal proliferation.

Symptoms. These are analogous to those of a very slow grade of acute peritonitis; constipation is frequent, œdema of the extremities and abdominal wall may be observed, albuminuria may occur and there is sometimes a mild type of fever.

Physical examination reveals the presence of ascites, and nodular thickenings and swellings within the abdomen may be felt.

The diagnosis is often very difficult; ascites due to hepatic disease may be differentiated by means of examination of the aspirated fluid. The fluid of peritonitis is higher in specific gravity (1,018), is less clear and contains more albumin.

Treatment. The treatment of chronic diffuse peritonitis is identical with that of the localized type of the inflammation.

Tapping and radical surgical measures may be undertaken if benefit seems likely to result.

NEOPLASMS OF THE PERITONÆUM.

These are of two main types, *tuberculous* (which has been dealt with under the general subject of tuberculosis) and *cancerous*.

Cancer of the peritonæum is usually secondary to similar disease of neighboring structures. Primary instances have, however, been observed. The secondary tumors are either metastatic in origin or the result of spread by contiguity. The peritonæum is studded with nodules of varying size, some being so small as to merit the term miliary, while others are much larger, the latter being most abundant in Douglas' pouch and in the omentum, which often becomes hardened and firm and may form an indurated tumor extending across the upper abdomen. Peritonæal cancer occurs as epithelial carcinoma and more rarely in a diffuse colloid form. The primary growths are probably endotheliomata.

Symptoms. The disease is more common in women and usually appears late in life. The clinical picture resembles that of chronic peritonitis but there is much more evident cachexia. Ascites is common and may obscure the evidences otherwise easily obtained by abdominal palpation. In other instances large nodules may be plainly felt and there may be a peritonæal fremitus. The retro-peritonæal and inguinal glands may be enlarged.

In the presence of primary cancerous disease of other organs the diagnosis is simplified and all possible seats of such affection, especially the stomach, rectum and uterus, should be thoroughly investigated. In the instances characterized by the miliary type of growth the differentiation from peritonæal tuberculosis is difficult. Aspiration may reveal the presence of hæmorrhagic fluid in either but this manifestation is more typical of the former condition and microscopic examination of the fluid may reveal cancer cells. The fluid re-accumulates more rapidly in malignant tumor, the development of cachexia is more rapid than in tuberculosis and the latter condition is more frequent in the young. In colloid cancer there is no ascites and a firm gelatinous substance is present instead.

Treatment is almost wholly symptomatic. For the pain morphine is often necessary. The bowels should be kept regularly active and accumulations of fluid which interfere with respiration and cardiac action should be drawn off; repeated tapping is sometimes indicated.

Radical surgical measures are generally considered inadvisable, these being useless, as a rule, except in the rare instance of single sarcomatous growths of the peritonæum, although instances have been reported in which omental tumors have been removed with the result of prolonging life. Recurrence, however, is almost certain to take place.

ASCITES.

Synonym. Hydroperitonæum.

Definition. A collection of serous fluid in the peritonæal cavity.

Ætiology. Ascites is rather a symptom than a disease and occurs directly as the result of any condition causing interference with the return of venous blood through the portal circulation, such as hepatic disease, particularly cirrhosis; tumor or inflammation in the gastro-hepatic omentum or hilum of the liver pressing upon the portal vein; abdominal tumors of any character which exert pressure upon this vessel; inflammations of the peritonæum of any character. Ascites is also observed in connection with chronic interstitial pneumonia, chronic pleuritic and pericardial adhesions and pulmonary emphysema. It is a prominent symptom in panserositis.

Of the general causes of ascites chronic valvular disease of the heart is the most important; here the hydroperitonæum occurs as a part of a diffuse anasarca or, more rarely, by itself; in such instances there is probably some lesion in the liver which must be held responsible. In chronic nephritis and conditions characterized by extreme anæmia, ascites is frequently a prominent symptom.

Symptoms. There is gradual progressive increase in the size of the abdomen and with the accumulation of a considerable quantity of fluid—8 to 10 quarts (litres)—typical physical signs become evident.

Inspection reveals a distention of the abdomen; this is pendulous when the patient stands and is flattened and widened when he lies upon his back. If there is a large amount of fluid the abdominal parietes are tense and the vertical lines (*lineæ albicantes*) which are seen upon the pregnant abdomen are often present. The superficial veins are distended and prominent and if there is marked obstruction to the portal circulation there may be a varicose condition of the veins about the umbilicus (the *caput Medusæ*). There may be accompanying œdema of other parts of the body, particularly the lower limbs.

Palpation reveals the presence of a fluid wave which is determined by placing one palm against one side of the abdomen and tapping the other with the fingers of the opposite hand. In order to avoid mistakes which may occur in fat subjects the ulnar border of the hand of a second observer may be placed vertically in the mid-line of the abdomen; this prevents the transmission of any false wave-like sensation. Palpation of the solid viscera is often difficult and is best accomplished by applying only the finger-tips to the overlying skin and suddenly depressing them, thus displacing the fluid and allowing contact with the organ to be appreciated.

Percussion elicits flatness over the fluid which falls back into the flanks when the patient is upon his back, while over the floating intestines which rise to the surface tympany is present. By causing the patient to roll to one side or the other a tympanitic note may be demonstrated in the flank which is uppermost, showing that the fluid is movable and consequently flows into the lowest portion of the abdomen. In small collections the tympanitic note over the middle of the abdomen becomes flat if the patient is put in the knee-elbow position.

The diagnosis of ascites sometimes offers difficulties; the most important conditions to be differentiated are:

Ovarian cyst. Here the enlargement of the abdomen begins low on one side and rises toward the center. The percussion note is flat here and tympanitic in the flanks whither the intestinal coils have been depressed. Vaginal examination is usually helpful in differentiation. The changes in the character of the percussion note are slight and quite different from those obtaining in ascites. The *fluid* of ascites is usually clear, of a specific gravity of about 1,012 and contains a little albumin and a few white blood cells, while that of ovarian tumor is dark, viscid, is higher in specific gravity, contains much albumin and cholesterin with granular cells of two types, fatty and pale. Bloody fluid is rather characteristic of cancerous ascites; it is less common in tuberculosis and rare in hepatic cirrhosis.

Chylous, milky fluid is found at times; true chyle is due to the leakage into the peritonæal cavity of the contents of the thoracic duct. Fatty fluid, resembling chyle but which under the microscope shows the presence of fat globules,

occurs in some forms of cancer of the peritonæum. Chylous ascites has been observed in filariasis and, in mild type, in patients with lipæmia resulting from continued milk diet.

The distended bladder may be mistaken for ascites but there is usually a characteristic history, the urine dribbles and the condition may be absolutely differentiated by catheterization.

Hydronephrosis of extreme degree may be confounded with ascites but the former condition is slow in evolution, there are usually symptoms referable to the kidney and the tumor is usually first noticed on one side of the mid-line.

Cysts of the omentum or pancreas, and hydatid cysts of the abdomen sometimes resemble collections of ascitic fluid.

Treatment depends upon the cause of the condition and for a discussion of the management of symptomatic ascites the reader is referred to the sections upon the treatment of cardiac, hepatic and renal disease. Tapping is often indicated to relieve the patient's discomfort and repetition of the operation may become necessary. The technique of the procedure has been fully described in the section upon the treatment of cirrhosis of the liver. Diminution of the chlorides of the diet, as outlined in the section upon the management of the dropsy of chronic nephritis, may be effectual in relieving the tendency to ascites.

CHAPTER V.

DISEASES OF THE BLOOD.

THE ANÆMIAS.

SECONDARY ANÆMIA.

Synonym. Symptomatic Anæmia.

Secondary Anæmia is the most common of the different types of blood poverty and occurs in various forms which may be best classified in accordance with their causation.

a. Anæmia following hæmorrhage. This type is observed as a result of loss of blood following traumatism, post-partum hæmorrhage, hæmorrhage from the lungs, stomach or intestines, aneurysmal rupture, hæmophilia, purpura, uncinariasis or hook-worm disease and other parasitic affections, such as the presence of *distoma hæmatobium* in the kidney.

Hæmorrhage from these causes, if sufficiently large, may cause death but in less severe instances the watery and saline constituents of the blood are quickly made up by absorption from the alimentary tract. Restoration of the albuminous substances is also rapid but a considerably longer time, even several months, may be necessary to complete restoration of the corpuscles and, more especially, of the hæmoglobin.

b. Anæmia resulting from the continued drain of chronic disease. Such conditions as chronic nephritis, malignant growths, protracted suppuration or lactation, chronic diarrhœas and malaria, produce anæmia as a result of their continued drain upon the albuminous constituents of the blood.

c. Inanition anæmia is produced by a lack of sufficient food and by conditions which prevent the ingestion, digestion or assimilation of food when there is no interference with the supply. It appears in such conditions as cancer of the œsophagus or of the stomach, where there is also additional anæmia due to the presence of the malignant growth, and in chronic digestive and assimilative disorders.

d. Toxic anæmia results from the presence in the circulation of such poisonous substances as lead, arsenic and mercury and may be observed in workers in paint, plumbers and type setters and in upholsterers and decorators. The organic toxins of syphilis and malaria are potent factors in the causation of this type of anæmia as are also those of the infectious diseases including

tuberculosis. These poisonous substances directly destroy the blood-corpuscles in some instances while in others they act by increasing the rapidity of their ordinary destruction.

Symptoms. Usually in secondary, as in other forms of anæmia, the skin, and particularly the mucous membranes, are pale but it is not unusual to observe the pallor and upon examination of the blood to find no marked poverty of the blood; likewise both skin and mucous membranes may appear normal in color when anæmia is present. Faintness, cardiac palpitation and dyspnœa on exertion are common.

Physical examination of the heart and vessels often reveals the presence of various functional or hæmic murmurs. These are of three types. The most common is the so-called *bruit du diable* or humming top murmur. This, like other hæmic murmurs, is ventriculo-systolic in time and is heard at the root of the neck when the head is turned to the left. It is musical in quality and resembles—as its designation signifies—the sound produced by a humming top; it is caused by the eddy produced by the current of thinned blood rushing from a large to a smaller vessel. Less frequently a ventriculo-systolic murmur of soft blowing quality is heard over the pulmonic area and still more rarely a ventriculo-systolic murmur is audible at the cardiac apex. This last *bruit* is due to a relaxation of the mitral ring resulting from weakness of the heart muscle caused by poor cardiac nutrition. The condition produced is a true relative insufficiency of the mitral valve. Of course it is quite possible for two or even all three of these murmurs to co-exist in the same patient.

These murmurs, strangely enough, afford a fairly reliable means of estimating the hæmoglobin percentage of the blood. When the first type of murmur is heard the blood probably contains about 80 percent. of hæmoglobin, in the presence of the second variety of *bruit*, about 60 percent. and when the third form is detected, about 40 to 50 percent.

Examination of the blood shows a reduction in the number of the red cells (the normal being about 5,000,000 per cubic millimeter) and a reduction in the percentage of hæmoglobin rather in excess of that of the number of red corpuscles. After hæmorrhage the average size of the red cells may be slightly reduced, their color is noticeably pale and a moderate number of poikilocytes may be noted. Soon after the hæmorrhage nucleated red cells and free nuclei appear in the blood. The leucocytes are moderately increased in number, especially the polynuclear neutrophiles while the small mononuclear lymphocytes are relatively diminished. As the condition of the blood returns to normal the leucocytosis gradually diminishes. The hæmoglobin percentage is somewhat lower than that of the red cells.

In anæmia due to chronic disease, the blood changes are similar to those described above, but the poikilocytosis may be more extreme; the nucleated

red cells are generally few and large nucleated corpuscles containing karyokinetic figures may be found. There is usually a leucocytosis but in very persistent chronic conditions the white blood cells may be diminished.

The blood of inanition anæmia is characterized by a relative diminution of the plasma over that of the red corpuscles.

The diagnosis is usually easily made from the history of the patient and from the existence of one of the causes. In doubtful instances examination of the blood will show the characteristic diminution of red cells and hæmoglobin in nearly equal proportion and the cellular changes described above.

Treatment. In anæmia following traumatism usually little is needed in the way of treatment save rest and plenty of nutritious food. Fresh air is essential and if the patient is confined to bed he should be placed in a freely ventilated room to which the sun has sufficient access. The administration of iron, although often unnecessary, may hasten recovery which frequently is surprisingly rapid.

The anæmia of chronic disease is more difficult of treatment and is usually impossible of cure without removal of the primary cause. Here nourishing food is necessary and one should not hesitate to allow a proper mixed diet even to the patient afflicted with chronic nephritis. Plenteous food is also a requirement of the sufferer from inanition and attempts should be made to render the alimentary tract capable of digesting and assimilating the same, for little is accomplished in the way of increasing the nutrition of the patient until this is done. Iron vitellin in half ounce (15.0) doses materially accelerates the cure.

Toxic anæmia necessitates the removal of the poisonous substances from the organism (see the sections upon lead, mercurial and arsenic poisoning and also those upon syphilis and malaria) and, as in preceding types of the condition, the administration of plenty of good food and of iron. In secondary anæmia this substance may be given in any of the various preparations suggested under the treatment of chlorosis (p. 504), and, as in the latter disease, arsenic is often a useful adjunct.

In malarial patients who continue to exhibit the symptoms of chronic malarial poisoning it is necessary to rid the blood of plasmodia before treatment of the anæmia will prove effectual. In such instances the organisms are often secluded in the spleen where they seem to enjoy a certain immunity to quinine as ordinarily administered but if the fluidextract of ergot in doses of 1 drachm (4.0) twice a day is given, the dosage being increased until the rate of the heart is slowed and the blood pressure increased, a physiological squeezing of the spleen follows and the plasmodia are forced into the circulation to become an easy prey to quinine which is best given hypodermatically in the form of the carbamide, 20 to 30 grains (1.33 to 2.0) in aqueous solution.

PRIMARY OR ESSENTIAL ANÆMIAS.

Chlorosis.

Synonyms. Chloræmia; Chloranæmia.

Definition. An anæmia characterized by a relative diminution of the hæmoglobin in the blood and most frequently observed in girls and young women.

Ætiology. While the direct causation of chlorosis is unknown there are certain well-recognized facts to be stated concerning the incidence of the disease. It occurs almost exclusively in the female sex, some clinicians definitely stating that they have never observed an instance in the male; it is most frequent between the ages of 13 and 17 although it may appear both earlier and later than these limits. Climatic influence is not a factor in its causation but it seems to be more common in blondes than in brunettes.

Predisposing factors are insufficient food, lack of fresh air, unhygienic surroundings, over-work, menstrual disorders, excessive emotion, especially of sexual character, and such hereditary influences as tuberculous disease. The wearing of too tightly laced corsets has been held responsible and the affection may be associated with developmental defects of the circulatory and generative systems. It has been suggested that chlorosis is the result of constipation and intestinal putrefaction, toxic substances being absorbed from the alimentary tract which interfere with the development of the red blood cells.

Pathology. Aside from the blood changes the affection has no characteristic pathology; the developmental defects sometimes observed in the heart, blood-vessels and genitalia are probably adventitious.

Symptoms. The skin is of a peculiar and characteristic yellowish-green hue which has given rise to the name of the disease; pigmented spots over the joints and other parts may be observed and in mild instances there may be a slight redness of the cheeks, particularly after exercise. The patient complains of weakness, dyspnœa on exertion and a tendency to faint; vertigo, cardiac palpitation and irregularity may be present. Functional cardiac murmurs such as those described on p. 501 may be audible; the pulse is soft and full and there may be pulsation of the veins of the neck and of other superficial veins. Venous thrombosis may occur. The face is often swollen and the ankles may become œdematous; the extremities are frequently cold. The patient is often despondent and easily irritated. Neuralgic headaches and menstrual disturbances, which are usually rather a manifestation of the affection than a factor in its causation, are common. A febrile movement of slight degree may be noted.

The patient's appetite is often depraved and she craves acid foods or even

various indigestible substances such as chalk. Gastric hyperacidity is common and constipation very frequent. The association of chlorosis, especially in subjects who are prone to wear tight corsets, with gastroptosis, enteroptosis and nephroptosis has been observed in numerous instances. The patient as a rule is well-nourished.

The Blood. The characteristic changes in this fluid are of the utmost importance in the diagnosis of the affection. The red cells are only moderately diminished in number—3,500,000 to 4,500,000 per cubic millimeter—while the diminution of the percentage of hæmoglobin is proportionately much greater—40 to 50 percent.—consequently the hæmoglobin index (the relative proportion between the hæmoglobin percentage and the number of red corpuscles) is low. This feature, while not absolutely constant, is typical of chlorosis and is observed in no other variety of anæmia. With the diminution of the hæmoglobin the iron content of the blood is diminished, the alkalinity of the fluid is increased and its color becomes noticeably lighter. Microscopically the red cells are of lighter color than normal and may be somewhat changed in shape. Poikilocytosis is usually present and in extreme instances of the disease may be marked. Large red blood cells (megalocytes) may be observed in small number but the average size of the red corpuscles is likely to be below normal. Some nucleated red cells may be noted. The number of white cells, as a rule, is close to the normal or very slightly increased.

The diagnosis, when proper methods are employed, is usually easy and may be made upon the characteristic appearance of the patient. Important points are the greenish-yellow tinge of the skin and the bluish-white color of the sclerotics. Tuberculosis may be ruled out by physical examination of the lungs, and cardiac disease by auscultation of the heart, while urinary examination will differentiate the disease from renal affections. Blood examination will clinch the diagnosis and enable the physician to rule out other forms of anæmia.

The prognosis is favorable under proper treatment although months may be necessary before a complete recovery is established.

Treatment. In the treatment of chlorosis iron is essential. Of the preparations of this substance there are two main groups, the inorganic and the massed, this term being applied to irons in inorganic combination, which are not dissociated by the gastric juice. The great objection to all the inorganic irons is that upon contact with the hydrochloric acid of the gastric juice they are converted into iron chloride. Even hæmoglobin and all other blood irons undergo this change, and while the action of iron chloride in chlorosis is beneficial it has certain disadvantages. This salt, when taken into the mouth, exercises an injurious action upon the teeth; it is irritant to the stomach; it causes constipation. These disadvantages we may overcome by giving iron in the same form in which it occurs in the food and consequently a massed

iron must be employed. In the present state of our knowledge of the chemistry and therapeutics of iron the necessary qualifications which an acceptable iron compound should possess are:

a. It must be in definite chemical organic combination.

b. It must be able to resist the action of the free hydrochloric acid of the gastric juice without becoming decomposed with the formation of iron chloride which has been demonstrated to coagulate the gastric mucosa, cause localized necrosis and produce inflammatory exudation.

c. It must not interfere with digestion.

d. It must not be irritating nor astringent.

e. It must show definite results in (1) an increase of the number of red blood cells and (2) in the amount of contained hæmoglobin.

At first sight hæmoglobin, when administered by mouth, would seem to be a proper organic iron for exhibition in anæmia and allied conditions; as a matter of fact, however, Cloetta as early as 1896 showed that it is not absorbed as such but is destroyed as soon as it enters the stomach. With this, the theory of the advantage of blood, or products made from blood, for oral administration, falls. The crucial test for the actual massed iron preparation is that of MacCallum. Briefly, a small quantity of ½ to 1 percent. solution of hæmatoxylin is added to the suspected iron compound. If the iron is inorganic, a characteristic blue-black color is produced; if the iron is organic or massed no color reaction results. That many so-called organic iron compounds are practically only combinations of iron salts with albuminoids is readily demonstrated by the addition to them of a few drops of silver nitrate solution, which will cause a precipitation of these albuminoids.

The solution of iron vitellin, marketed as ovoferrin, is a definite true organic iron compound in that it complies with all the requirements given above and is applicable in all instances where a massed iron is desired. Its usual dosage is ½ an ounce (15.0) 3 times daily before meals, and it is the most satisfactory form of administering this important element.

In instances where the susceptibility of the stomach does not preclude their administration, increasing doses of the astringent salts, especially iron sulphate and chloride may be given to advantage. Large quantities of these salts are often well borne, but it must be remembered that considerable amounts of the sulphate have been known to cause intestinal obstruction. When they produce untoward effects they should be replaced by other preparations, preferably the most astringent ones which the stomach will tolerate. The astringent iron compounds lose, to some extent, their styptic taste when combined with glycerin, which also has the effect of reducing some of the ferric to a ferrous salt. To restore the hæmoglobin and red blood cells small doses of reduced iron—1 to 2 grains (0.065 to 0.13)—of the carbonate or of some one of the combinations with vegetable acids are usually the most serviceable.

As the scale preparations rarely disagree they may be used for patients with weak digestions and in small doses can usually be continued for indefinite periods. Oftentimes in chlorosis better results are obtained from iron with strychnine or arsenic than from iron alone, the syrup of iron, quinine and strychnine phosphate, the elixir of iron, strychnine and quinine of the National Formulary and the pill of the three phosphates which contains 1 grain (0.065) of quinine, $\frac{1}{32}$ of a grain (0.002) of strychnine, $1\frac{1}{2}$ minims (0.10) of concentrated phosphoric acid and licorice powder to 5 grains (0.33) being useful preparations. Iron arsenate $\frac{1}{8}$ to $\frac{1}{10}$ of a grain (0.008 to 0.006) is an excellent remedy in chlorosis. Iron may also be given hypodermatically when gastric disorders preclude its exhibition by the mouth. The following formula may be employed: Iron and ammonium citrate, 75 grains (5.0), sodium arsenate $\frac{3}{4}$ of a grain (0.048), sterilized water to $12\frac{1}{2}$ drachms (50.0), 15 to 30 minims (1.0 to 2.0) daily to be injected into the muscles of the shoulder or buttock. Usually the use of iron must be persisted in for a period of several months and it may be necessary to continue the treatment, the doses being diminished, for even longer periods. Recurrences of the chlorosis, which are not uncommon, necessitate a renewal of treatment. With regard to manganese in anæmic conditions it may be definitely stated that as a regenerator of the hæmoglobin and red cells it is absolutely inert.

The importance of proper treatment for the accompanying constipation cannot be over-rated. The daily administration of a mild saline purge is often indicated and in obstinate instances the condition should be treated as advised in the section upon the treatment of constipation.

Gastric disorders such as hypochlorhydria, etc., should receive appropriate treatment. The administration of dilute hydrochloric acid in 10 drop (0.66) doses in a glass of water to be taken with meals is advised in conditions of low gastric acidity, the acid being useful in dissolving the iron as well as in correcting the secretory abnormality.

The theory has been advanced by Bunge that intestinal fermentation by producing sulphides interferes with the proper absorption of the iron of the food and, in order to prevent this decomposing process, it is suggested that in connection with other treatment, it is well to render the intestinal contents as nearly aseptic as possible by giving such intestinal antiseptics as bismuth naphtholate—5 grains (0.33)—3 times a day or sodium glycocholate $\frac{1}{2}$ grain (0.032), with a little menthol to prevent distressing eructations, at similar intervals. The absence of intestinal decomposition is shown by testing the urine for indican and the disappearance of the sulphides from the stools by giving bismuth subnitrate which, in the presence of these substances, causes the fæces to assume a black color.

In connection with the drug treatment of anæmia the diet and general hygiene of the patient should also be considered. Rest in bed is important,

particularly in severe instances, and plenty of good easily digestible food should be allowed. The foods which contain iron, such as fish, spinach, apples, oats, beef, lentils, strawberries, beans, potatoes, eggs, wheat, rye, veal, milk, rice, etc., should be eaten in abundance and the red wines, and natural chalybeate waters such as those of La Bourbole, Levico, Flitwick, and the Columbian Spring, Saratoga, may prove useful. As the hæmoglobin becomes increased the patient may be allowed to sit up for a little time each day until finally she remains up all day. During this period massage may be employed to advantage as well as mild hydrotherapeutic measures, tepid sponging, douching and the like. For a considerable period after being out of bed the patient should not be allowed to tire herself but as strength returns she may be permitted to indulge in the milder forms of exercise. Sea voyages and a change of climate, particularly a sojourn at the sea side, will materially benefit the patient's condition during convalescence.

Progressive Pernicious Anæmia.

Definition. A chronic anæmia characterized by a marked diminution of the red blood cells and a relatively high hæmoglobin content.

Ætiology. The disease is rather rare in the United States. It appears to affect males rather more commonly than women and usually appears after the incidence of middle age but has been observed in young adults and in children.

Its actual causation has not been definitely determined; in some instances it appears during pregnancy but may occur after delivery and during lactation as well. The anæmia caused by certain intestinal parasites, particularly the *bothriocephalus latus* and the *anchylostomum duodenale* is often of the progressively pernicious type, and as other causes, severe and protracted digestive disorders and gastric atrophy may be mentioned. Still another type of the disease occurs idiopathically without previous hæmorrhage, renal, tuberculous, diarrhœal, malignant or other disease and attributable to no discoverable cause. The condition of the blood which obtains in pernicious anæmia has been considered as resulting from hæmolysis with an accumulation of iron in the liver and an abnormal increase of the urobilin of the urine. The destruction of the blood cells is believed by the adherents of the theory of increased hæmolysis to be due to the absorption of toxic substances generated as a result of improper performance of the digestive function. Other theorists hold that small internal capillary hæmorrhages are in great measure responsible for the disease, while still others consider that it is due to a faulty hæmogenesis which turns out red cells of poor powers of resistance.

Pathology. The usual hue of the skin is suggestive of that of the lemon, the fat is light yellow and the voluntary muscles are distinctly, even abnormally

red. The heart muscle is yellowish from its infiltration of fat. The stomach may be normal but in certain instances an atrophy of the gastric tubules has been observed. Enlargement and fatty degeneration of the liver are common and in the liver cells of the outer and middle zones of the lobules iron is deposited which may be distributed in such a manner as to outline the bile capillaries. This deposition of iron in the hepatic cells has been considered characteristic of pernicious anæmia. The spleen may contain iron in excess and may be smaller than normal but these changes are not constant. The kidneys also may show an increased quantity of iron. The bone-marrow is dark red, its lymphoid cells are increased in number and it contains many nucleated red blood cells especially megalo- or gigantoblasts. Eosinophiles and neutrophiles are also present.

Associated changes in the nervous system, such as alterations in the cells of the posterior columns of the cord and softening of the upper portion of the lumbar cord, have been described.

Symptoms. The onset of the disease is gradual and may be preceded by symptoms of digestive disorder. The patient notices an increasing weakness finally becoming extreme even to prostration; accompanying the physical debility there is usually progressive distaste for mental exertion. The maintenance of body weight is remarkable and characteristic, emaciation being a rare manifestation. The skin assumes the typical lemon-yellow tinge which in extreme degrees simulates that of jaundice. The yellow color is usually preceded by pallor and may be absent in certain instances. A pigmentation resembling that of Addison's disease is often observed, usually occurring as a result of the administration of arsenic. Patches of leucoderma may be noted. The sclerotics are usually pearly white. The mucous membranes are markedly pale.

Digestive symptoms are frequent; anorexia, nausea and vomiting and obstinate diarrhœa are the most common of these.

A moderate febrile movement of irregular type it not rare. The urine is, as a rule, of low specific gravity and either light or of very dark color due to the presence of an increased amount of urobilin.

Circulatory symptoms are very noticeable. The pulse is large, full and may suggest the pulse of aortic insufficiency. The pulsation in the capillaries is often visible and visible pulsation of the arteries and even of the veins may occur; murmurs of functional type (see p. 501) are frequent. Hæmorrhages into the skin, mucous membranes or retinæ may take place. A tendency to fainting or to dyspnœa on exertion is often observed.

Nervous symptoms, such as numbness of the extremities, pain and the symptoms of sclerotic change in the postero-lateral columns of the cord, may develop.

The blood changes are frequently very characteristic. In color the blood

may be quite pale, dark or normal. In consistency it is thin, the specific gravity is reduced in extreme instances and coagulation is retarded. As a rule there is great reduction in the number of red corpuscles, the average being not far from 1,000,000 per cubic millimeter. Fresh specimens reveal a marked poikilocytosis and the absence of any great degree of rouleau formation. The average diameter of the red cells is increased, the reverse of the condition present in chlorosis and secondary anæmia. Large red cells (macrocytes) are often abundant even early in the disease. Gigantoblasts (very large nucleated red corpuscles) may be present late in the disease, these are the most abundant of the three types of nucleated red cells which may be observed, the others being normoblasts and microblasts, the latter being usually few. The normoblasts are, as a rule, fewer than the megaloblasts, while in secondary anæmia the opposite is the case. Red blood cells with the faint remains of nuclei are not uncommon and karyokinetic figures may be seen in the megaloblasts.

The hæmoglobin is not diminished in proportion to the reduction in the number of red cells, the hæmoglobin index being high in consequence. This appears to be due to the fact that the megalocytes contain a relatively greater amount of hæmoglobin than does a corresponding number of normal sized corpuscles; this is a characteristic of pernicious anæmia.

The leucocytes are usually diminished, 4,000 to the cubic millimeter being a fair average. There is a relative increase in the lymphocytes and a decrease in the number of polynuclear neutrophiles.

The diagnosis in severe instances is easily made upon blood examination; in milder instances the separation of the disease from other anæmias is more difficult, points in favor of pernicious anæmia being the presence of megalocytes and megaloblasts, the low leucocytosis with lymphocytosis and the high hæmoglobin index.

The prognosis is usually unfavorable although recovery has been observed and temporary improvement is fairly common. The idiopathic instances of the disease usually do badly as also do those whose blood shows a large number of large nucleated red corpuscles. Digestive disturbances are unfavorable manifestations and patients who do not tolerate arsenic well are likely to fare badly.

Treatment. The dietetic, hygienic and massage treatment recommended for chlorosis is quite as important in the management of pernicious anæmia. Prolonged rest in bed is often necessary and almost always advisable; free ventilation of the sick-room is to be insisted upon, in fact, if circumstances and the weather permit, improvement will usually progress with greater rapidity if the patient's couch is taken out of doors each day for a considerable period of time.

The drug which exerts the most favorable effect in pernicious anæmia is

arsenic; unfortunately, however, certain patients do not bear it well and frequently it tends to cause gastric disturbances which necessitate its intermission. It may be administered in various forms of which perhaps the solution of potassium arsenite (Fowler's solution) is to be preferred both on account of the results obtained by its use and its convenience. Increasing doses are usually prescribed, beginning with 3 or 4 minims (0.20 to 0.25) 3 times a day, well diluted and after meals. This dose should be gradually increased by 1 minim (0.065) every week or 10 days until 20 to 30 minims (1.33 to 2.0) thrice daily are reached. If well borne the patient should be advised to continue the medication until marked improvement is noticed. Should symptoms of gastric irritation appear the arsenic should be immediately stopped, to be resumed as soon as the untoward manifestations disappear. Arsenic may also be prescribed in the form of arsenic trioxide, or as sodium or iron arsenate in the ordinary doses gradually increased. If the digestive disturbance caused by the administration of the arsenic by mouth is obstinate or if the exhibition of the drug by mouth is barred for any other reason we may have recourse to hypodermatic injections. Fowler's solution mixed with twice its bulk of sterile water may be given by this method in little less than the oral dosage. It is somewhat irritating and upon this account it may be advisable to substitute sodium dimethyl arsenate (sodium cacodylate) $\frac{1}{3}$ to 1 grain (0.022 to 0.065) or disodium methyl arsenate (arrhenal) $\frac{3}{4}$ to $1\frac{1}{2}$ grains (0.048 to 0.1). Both these are easily soluble in water and may also be given by mouth. They are said to be less disturbing to the digestive tract than the older preparations. Arsenic may also be administered rectally in the form of Fowler's solution or, if preferred, one of the salts just mentioned may be so employed, the dosage being about twice that advised for oral use.

Iron may be combined with the arsenic in certain instances in which the latter drug alone seems insufficient. When this is the case the iron may be prescribed as suggested under the treatment of chlorosis.

Late in the disease inhalations of oxygen have been advised and may be beneficial. If the patient desires it a systematic treatment by means of oxygen inhalations may be begun in the early stages.

The diminution in the quantity of the circulating blood which is likely to take place near the termination of the affection should be combated by giving hot normal salt solution by enteroclysis, hypodermatoclysis or even by intravenous infusion.

The use of bone-marrow has been suggested and has seemed beneficial in certain instances, while in others it has had no effect. It may be given fresh or as the glycerin extract in quantities of an ounce to two ounces (30.0 to 60.0) daily.

The frequently associated gastro-intestinal disturbances, which result from

irritation of the stomach, or intestinal fermentation should receive appropriate treatment in the form of gastric lavage or the administration of intestinal antiseptics such as bismuth naphtholate or tetraiodophenolphthaleinate in doses of 5 grains (0.33), phenyl salicylate, etc. The vegetable bitters and hydrochloric acid are sometimes beneficial. Fortunately in pernicious anæmia there seems to be a certain amount of tolerance on the part of the stomach for arsenic, else gastric irritation would be more frequently observed.

On the ground that general septic infection is likely to occur during the course of the disease the use of antistreptococcus serum has been advised.

When there is evidence that the presence of intestinal parasites is responsible for the affection, anthelmintics should be administered (see the section on intestinal parasites).

After the more marked manifestations of the disease have subsided, that is to say during the convalescent period, iron should be prescribed. The first sign of any recurrence is a signal for the renewal of the administration of arsenic.

LEUCÆMIA.

Synonym. Leucocythæmia.

Definition. A disease of the blood characterized by a considerable and persistent increase in the number of the white corpuscles and changes in the spleen, lymphatic glands and bone-marrow, one or all.

Two distinct forms, which in many instances, however, are so varied or combined that definite separation becomes impossible, are described: *a*, *Spleno-medullary* or *myelogenous leucæmia* and *b*, *Lymphatic leucæmia*.

Ætiology. The disease is common to all countries and, while it may occur at any age and in both sexes, is more frequent in males during middle life. Heredity has some influence in its incidence, a leucæmic mother may, however, bear healthy children. The affection has followed splenic traumatism, and syphilis has been considered in its causation but these probably have little to do with its ætiology. Leucæmia has been noted in malarial patients but it is by no means certain that the circumstance has been more than adventitious. It may develop during pregnancy or at menopause. Unsanitary conditions of life may be considered as predisposing factors.

The definite causation of leucæmia is unknown although the possibility of its microbic origin has been seriously considered, and it has been held to be the result of the absorption of toxic substances from the digestive tract which bring about a disordered action of the blood-making organs.

Pathology. The body is usually emaciated, often extremely so, subcutaneous œdema and transudates into the serous cavities may be observed. The large veins and the heart contain greenish-yellow or whitish coagula which

look like pus. Fatty degeneration of the myocardium and pericardial and endocardial ecchymoses may be present.

In *spleno-medullary leucæmia* there is marked splenic enlargement, the organ sometimes weighing as much as 18 lbs. (9 kg.). It is often adherent to adjacent structures and its capsule may be thickened. It resists the knife but on section is brownish or mottled by lymphoid tumors of grayish or yellowish tinge or by yellowish-brown hæmorrhagic infarcts. The outline of the Malpighian bodies is usually not distinct. Under the microscope the condition proves to be one of hyperplasia and areas of fatty degeneration and of increased connective tissue may be apparent.

There is also hyperplasia of the red marrow which, instead of being fatty, is yellowish-green in color and resembles pus or is dark brown; infarcts may be present and the bone itself may be enlarged. The microscope reveals the presence of many lymphoid and nucleated red blood cells in the marrow substance. Many polynuclear leucocytes are to be seen and small mononuclear white cells are also present but in smaller number.

Some enlargement of the lymph glands is usually noted.

Lymphatic leucæmia is characterized by general hyperplasia of the lymphatic glands usually associated with some splenic hypertrophy. The enlarged glands are soft and movable and reddish-gray in color. Lymphatic tissue throughout the body, as the tonsils, the buccal, lingual and pharyngeal lymph follicles and the solitary and agminated glands of the intestine, may take part in the hyperplastic process. Rarely is the thymus affected. Lymphoid tissue may replace the bone-marrow.

The liver is usually enlarged and with the kidneys may be the seat of lymphatic infiltration and at times may contain distinct lymphatic growths which also have been found in the stomach, omentum and even in the skin. Cardiac and pulmonary changes do not occur.

Symptoms. The onset of the disease is gradual with pallor, palpitation, dyspnœa, progressive weakness, digestive disturbances and abdominal or glandular enlargement. Epistaxes or hæmatemeses may be amongst the early symptoms and have proved fatal in a few instances almost before the patient's true condition had been suspected.

Spleno-medullary or *myelogenous leucæmia* is the more common type of the disease and, as its name indicates, is characterized particularly by splenic enlargement. The increase in size is gradual and pain and tenderness over the organ may be present. The enlarged spleen is usually palpable below the costal margin and when extraordinary increase in size is present the organ may extend to the left as far as the umbilicus and downward to the pubes. Its edge is easily made out and the splenic notch may be readily felt. The size may vary from time to time becoming smaller after hæmorrhage or diarrhœa and larger after a full meal. Slight degrees of enlarge-

ment may be detected by percussion, the normal splenic dulness being limited by Luschka's lines which are drawn from the posterior superior iliac spine to the nipple and from the umbilicus tangent to the lower margin of the eleventh rib. The former is directly in the short axis of the organ, the latter in its long axis. Palpation of the organ may reveal pulsation and a creaking fremitus and, upon auscultation over it, a murmur may be audible. The aorta may be prominent in the supra-sternal notch (Jaccoud's sign).

The heart may be displaced upward by the splenic tumor. The pulse is likely to be rapid, soft and full. Œdema, localized in the lower limbs or general, may occur in the later stages of the disease. Hæmorrhages, especially epistaxes, are frequent. Subcutaneous extravasations of blood, hæmatemeses, bleeding from the gums, into the retina, the meninges or into the serous cavities may be observed. Hæmorrhages from the bowel and diarrhœa sometimes take place. Ascites due to venous obstruction by the pressure of the splenic tumor is not uncommon and digestive symptoms, especially nausea and vomiting, are often noted. Gangrenous processes with fever of septic type are serious manifestations. Priapism is not infrequent.

Dyspnœa, headaches, vertigo and a tendency to faintness occur as a result of the anæmia. Deafness sometimes is present and symptoms resembling those of Ménière's disease may appear, due to involvement of the semi-circular canals. Hæmorrhagic retinitis and changes due to leucæmic growths in the retina may be observed. An irregular febrile movement is common. The urine is not characteristic but usually contains an increased amount of uric acid.

The blood shows certain changes common to all types of the disease; its color may be very pale. Upon coagulation, when the white cells are much increased in number, the blood separates into two layers one containing chiefly leucocytes, the other the red corpuscles. The specific gravity is usually low and Charcot's crystals appear when the blood is allowed to stand for a time.

The changes characteristic of *spleno-medullary leucæmia* are as follows:

The red cells may be nearly normal in number or greatly reduced—even below 1,000,000. The hæmoglobin is reduced out of proportion to the diminution of the number of red cells, there are some poikilocytes and nucleated red cells; in less frequent instances the hæmoglobin index is high and many megalocytes and megaloblasts are present. The white cells are greatly increased in number except in the mildest types of the affection, the average being 100,000 to 200,000 in the early stages to over 1,000,000 late in the disease. Under the administration of arsenic or during remissions the number may fall to normal but myelocytes are almost invariably present. The normal amœboid movement of the polynuclear cells is diminished and the myelocytes may be slightly motile. There is a constant increase in the polynuclear neutrophiles and these may number 200,000 or more. Their size is much

more variable than in normal blood, their neutrophile granules may be absent or scarce. The polynuclear eosinophiles are also increased but are not changed in character and the large mononuclear cells are often increased as well. Cells with basophilic granules and polymorphous nuclei are frequently present in considerable number. The large and small lymphocytes remain normal or undergo moderate increase in number.

The myelocytes are characteristic and pathognomonic. These are not present in normal blood; they are large mononuclear cells and occur in three forms, neutrophilic, eosinophilic and basophilic, the first being most abundant and the last least common of the three. The neutrophilic forms have a large oval nucleus and contain a varying quantity of neutrophilic granules. At times they are very large and in advanced instances of the disease degenerated forms are frequent. The eosinophilic myelocytes are fairly characteristic of leucæmia but may not be present in large numbers. The basophiles resemble the eosinophilic myelocytes but are fewer in number.

The myelocytes are found in great numbers in the spleen, lymph glands and liver. During acute infections, occurring in the course of leucæmia, they may be greatly reduced in number in the circulation or even wholly disappear and, if the infective process is long continued, their number in the organs is also decreased as is evidenced by a reduction in the splenic and hepatic enlargements. Similar diminutions may occur after the administration of arsenic and just before death.

Lymphatic leucæmia is more rare than the preceding type of the disease and is prone to occur in an acute and rapidly fatal form. It occurs more often in the young and is characterized more particularly by enlargement in the superficial lymphatic glands. The tumors remain soft, movable and elastic.

The disease in its more acute type may resemble enteric fever, sepsis or scurvy. The febrile movement is moderate, the anæmia rapidly increases, hæmorrhages take place and the spleen and liver are only moderately enlarged. Lymphatic deposits in the skin may occur.

The Blood. In the more acute instances there is rapid diminution of the red cells to 2,000,000 or less and normoblasts and megaloblasts may be found, the latter rarely. The leucocytes are increased but much less so than in spleno-myelogenous leucæmia. Myelocytes are seldom present but may be seen in small number. The increase in the number of leucocytes affects chiefly the large and small lymphocytes; there is relative diminution of the eosinophiles and varying numbers of polynuclear and large mononuclear cells are observed. The characteristic change is the presence of large lymphocytes. In these, at times, degeneration both of cell body and nucleus is seen. The appearance of acute intercurrent disease reduces the leucocytosis, causing at the same time a relative increase in the polynuclear neutrophiles.

Protracted infections may cause a disappearance of the lesions in the marrow and of the cutaneous lymphatic growths.

The hæmoglobin is diminished in close proportion to the reduction in the number of red corpuscles.

In *chronic lymphatic leucæmia* the blood changes are somewhat different. Usually there is less diminution of the red cells, the nucleated reds are fewer and are mostly normoblasts; crises of normoblasts may occur. The average leucocytosis is about 100,000 but a count of four or five times this number is not rare. The increase in the number of leucocytes chiefly affects the small lymphocytes. A small number of eosinophiles, neutrophiles and myelocytes may be present. Variations in the leucocytosis are common and during intercurrent febrile disease the leucocytosis may fall temporarily to normal. The hæmoglobin index is low.

The diagnosis cannot be accurately made without examination of the blood, but the microscopical study of this fluid together with a differential counting of the leucocytes will separate the disease from pseudo-leucæmia and the various anæmias whose clinical resemblance to leucæmia may be extremely close.

The prognosis is generally unfavorable but remissions of the progress of the affection are not infrequent and a few instances of apparent cure have been reported; death, however, usually takes place within about three years and often in less time; the patients who have frequent hæmorrhages, a marked febrile movement and anasarca are likely to do badly.

Treatment. The diet and hygiene of this disease are identical with that of pernicious anæmia, and rest in bed is quite as important a factor in the management of leucæmia as in that of the previously considered affection. The administration of arsenic in the manner suggested for pernicious anæmia often is beneficial and should not be neglected. Iron is also useful and inhalations of oxygen are said to exert a curative effect. They should be employed daily and in amount varying from 5 to 12 gallons (20 to 50 litres). Bone-marrow may be given either fresh or as the glycerin extract in quantities of 1 to 2 ounces (30.0 to 60.0) daily but is hardly likely to influence the progress of the disease materially.

Recent remarkable results have been achieved with the Röntgen ray. The reason for its beneficent action is not well understood but under its influence there is a diminution of the number of the leucocytes in the blood as well as of the size of the spleen. It is probable that the ray determines an autolysis, analogous to that which occurs after pneumonia and as a result of which the exudate of the disease is absorbed, and that the end-products of the excessive number of white cells are excreted through the urine, causing an increase in the uric acid, phosphates and purin bodies which this fluid contains. Certain it is, at any rate, that improvement of leucæmic patients

is evidenced by an increased uric acid, phosphate and purin excretion in the urine. Cures have been reported in instances of spleno-myelogenous leucæmia but the X-ray seems to be less efficient in the lymphatic type of the affection. With the diminution in the splenic tumor and in the leucocytosis it is stated that the red cells and their hæmoglobin content are increased, the glandular swellings become smaller and that the general condition becomes in every way improved. The technique of the treatment consists in applying the light over the spleen, the enlarged glands, the chest, knees and elbows. The tube must be so excited as to give a light penetrating enough to reach the diseased organs. A relatively hard tube should be used; the low vacuum tube, which expends its energy upon but does not penetrate the skin, is to be avoided, this being the type of tube which produces burns. It is important that the genitals should always be protected by an impenetrable screen lest sterility be caused. In summing up this treatment of leucæmia it may be said that at present too few results have been reported to form any absolute conclusions as to its efficacy; it should, however, be employed in all instances, for while recovery may not be brought about, benefit is usually achieved.

The surgical treatment of leucæmia by means of splenectomy has been suggested but it offers no very definite hope of cure.

LEUCANÆMIA.

This term has been applied by von Leube to conditions which exhibit a combination of the features of marked anæmia and leucæmia. The affection is usually acute in onset and in course, is apparently an infective process and frequently begins with an inflammation of the tonsils. It is characterized by prostration, fever, marked pallor, hæmorrhages and splenic and hepatic enlargement; glandular tumors may be present. The red cells are greatly diminished and there may be numerous normoblasts and megaloblasts; the hæmoglobin percentage is relatively high. The leucocytes may not be greatly increased in number but there is usually relative increase in the number of lymphocytes.

The condition is usually fatal in from one week to two or three months.

Other observers have reported leucanæmic states which resemble on the one hand acute myelogenous leucæmia and on the other an acute infectious disease.

CHLOROMA.

This is a condition apparently allied to leucæmia, characterized by the development of greenish color in the periosteum and marrow of the cranial bones especially in those about the orbit. Metastatic growths may appear in the organs. Lymphoid infiltration of the conjunctiva and cornea may occur.

The disease may be classed as related to lymphosarcoma as well as to leucæmia and is believed to consist in a neoplastic hyperplasia of the parent cells of the leucocytes which develops in the red marrow, the periosteum being secondarily affected.

The symptoms consist of orbital pain, exophthalmos, deafness, epistaxis and subconjunctival hæmorrhage. There is progressive weakness with pallor, anæmia and leucocytosis, the latter not being essential. Resilient tumors appear in the orbital, temporal and parotid regions and there may be paralyses due to pressure exerted upon the nerve trunks by tumors growing from the spinal periosteum. The evolution of the disease is rapid and its termination fatal.

CHRONIC CYANOSIS. (VAQUEZ'S DISEASE.)

Definition. A rare condition characterized by chronic cyanosis of the skin, polycythæmia and splenic enlargement.

The causation of the disease is unknown but the affection is evidently distinct from the polycythæmia which occurs with tuberculosis of the spleen, in congenital heart disease and in subjects who have lived at a high altitude. The most typical symptom is the cyanosis which is usually associated with an enlarged spleen. Accompanying symptoms are weakness, prostration and headache with vertigo, abdominal and dorsal pain in certain instances; albuminuria and digestive disturbances may be present. There is no fever nor vascular hypertension.

The blood is dark in color and its viscosity is increased; the specific gravity may reach 1,083 and the hæmoglobin percentage even as high as 200. The red blood cells are markedly increased in number and may be even as many as 13,000,000 per cubic millimeter. There is usually no extreme leucocytosis, the average number of white cells being below 10,000 although a number as high as 30,000 has been observed. Fatal instances of the affection have been noted.

ANÆMIA INFANTUM.

Synonym. Anæmia Infantum Pseudo-leucæmica.

Definition. A disease of childhood which resembles leucæmia but in which the leucocytosis is less marked, there are no lymphomatous tumors and from which recovery may take place.

Ætiology. The causation of the affection is unknown but rickets, syphilis and digestive disorders may be contributing factors. The condition is very rare but may occur in children between the ages of 1 and 7 years.

Pathology. The most characteristic lesion is a considerable splenic enlargement of simple hyperplastic type. The liver may be enlarged and the lymph

glands may be increased in size. The marrow may be redder than normal, there are never any lymphomatous growths.

Symptoms. The onset is gradual with increasing pallor although a corresponding emaciation may not take place. The spleen is palpably enlarged and may vary in size from time to time. Hepatic enlargement may or may not be present, the same is true of glandular swellings. Digestive disturbances are frequent. The course of the affection is chronic and protracted; recovery with gradual amelioration of all the symptoms and a return of the blood to normal may occur.

The Blood. The specific gravity is diminished. There is marked diminution in the number of red cells (2,000,000 or even fewer) and there are changes in size and shape; nucleated cells of normal size may be numerous and in the severer instances of the disease megaloblasts may be observed in considerable number. The leucocytosis may reach 100,000 but is usually from 20,000 to 50,000, varying upon occasions. While the normal proportions of the different types of white cells are said to persist the mono- or polynuclear forms may be relatively increased. Myelocytes are rarely seen.

The diagnosis may be made upon the presence of syphilis or rickets with digestive disorders, enlarged spleen, anæmia with leucocytosis and the absence of myelocytes from the blood and of hæmorrhages and lymphomatous tumors.

The prognosis should be guarded. Recovery from the condition itself may take place but intercurrent affections often result fatally.

Treatment. If syphilis, rickets or gastro-intestinal derangements are present they should receive appropriate treatment. The management of the disease itself should be conducted as in leucæmia or severe anæmia. The Röntgen rays should be used with caution in children.

PURPURA

Synonyms. Morbus Maculosus; Peliosis.

Definition. The term purpura is applied to a number of dyscrasiæ which are characterized by extravasations of blood beneath the skin or mucous membranes. These hæmorrhages vary greatly in extent; when of minute size they are termed petechiæ, when larger, ecchymoses; they do not disappear on pressure; when fresh they are of bright red color, later becoming brownish, Associated with the tendency to purpuric hæmorrhages there is a diminished disposition upon the part of the blood to coagulate.

While it is difficult to separate the different types of purpura, the following classification is the one usually given:

Symptomatic purpura comprises those types of the affection which occur in association with and as a part of the symptom complex of various diseases and conditions.

a. The severer forms of the infectious diseases often exhibit a purpuric rash and ecchymoses are not infrequent in septic and pyæmic conditions; they are very common in infectious endocarditis and in epidemic cerebro-spinal meningitis.

b. The presence of various poisons in the blood—snake venom, overdoses of various drugs such as mercury, ergot, potassium iodide, quinine, etc.—is sometimes evidenced by purpuric spots. Certain subjects who possess idiosyncrasies may exhibit the hæmorrhages after the administration of physiological doses of these substances.

c. In the cachexia of such chronic diseases as carcinoma, nephritis, tuberculosis, pseudo-leucæmia, etc., purpuric extravasations are often observed.

d. Nervous affections, both organic, such as tabes dorsalis, myelitis and neuralgia, and functional—as in hysteria—may be accompanied by a symptomatic purpura.

e. Mechanically produced ecchymoses may appear in any condition in which circulation is impeded, such as a paroxysm in whooping cough or epilepsy.

f. Senile purpura; in aged individuals it is not unusual to note subcutaneous hæmorrhagic extravasations, especially upon the extremities.

Arthritic Purpura.

In this form of the affection joint lesions are the characteristic feature.

Arthritic purpura may be separated into three varieties:

a. Simple arthritic purpura or *purpura simplex* occurring usually in children; this is a mild affection and is characterized by pain about the joints, slight febrile movement and sometimes by digestive disorders and diarrhœa. The patient may lose some flesh and become somewhat anæmic. Ecchymoses are present upon the limbs, chiefly about the knees, but they may be observed upon the arms and body. Recovery within ten days generally takes place.

b. Peliosis rheumatica or Schönlein's disease is a more serious condition. It is most common in young adult males and is characterized by multiple joint involvement. The articulations are swollen, tender and painful and there is a rise of temperature, as high as 103° F. (39.4° C.) in some instances. Pharyngitis may be an initial symptom. The rash appears first about the affected joints and may be purpuric or urticarial. Nodes similar to those of erythema nodosum may be noted. Vesicles (*pemphigoid purpura*) may be present and necrosis with sloughing of the skin and even of the soft palate may take place. There may be, in severe types of the affection, albuminuria and even hæmaturia; endocarditis and pericarditis are rare complications. Recovery is the rule but relapses and recurrences are not uncommon.

c. Henoch's purpura or *purpura with visceral lesions* is seen particularly in children but may occur in adults and, while it is associated with various

cutaneous lesions such as ecchymoses, urticaria, angioneurotic œdema or different types of erythema, its more especial characteristic is a gastro-intestinal disturbance evidenced by colic, nausea, vomiting and diarrhœa; joint involvement is often present and the same is true of splenic enlargement. Nephritis is a severe complication and may cause death. The gastro-enteric and renal manifestations are probably the result of the occurrence of lesions of the digestive tract and kidneys analogous to those of the skin.

Purpura Hæmorrhagica.

Synonym. Morbus Maculosus Werlhofii.

This variety of purpura is most often seen in debilitated subjects, particularly young girls, although healthy adults may be attacked. The condition is characterized by the occurrence of hæmorrhages from the mucous membranes of the nose, mouth and gastro-intestinal tract as well as into the skin. The hæmorrhages may be severe, the cutaneous ecchymoses rapidly increase in size and marked anæmia quickly results. There is usually a moderate febrile movement. The onset is usually preceded by a few days of malaise and weakness.

Death may take place from loss of blood or as a result of hæmorrhage into the brain. In the instances which recover the affection usually lasts two or three weeks.

Purpura fulminans occurs chiefly in children and is rapidly fatal, there being extravasations into the skin of large extent, usually without involvement of the mucous membranes.

The diagnosis. Purpura hæmorrhagica is to be separated from scurvy by the lack of involvement of the gums. In the hæmorrhagic types of the infectious diseases there is a more marked rise of temperature with characteristic symptoms.

The prognosis is usually favorable but in purpura fulminans death occurs, often within twenty-four hours.

Treatment. The tendency to purpuric disease should be combated by the employment of all possible means which will build up the patient's general condition. Of these good food and plenty of fresh air with proper exercise and attention to the general hygiene are of paramount importance. A sojourn in a warm climate is very beneficial. Any anæmic manifestations necessitate the administration of iron.

In the arthritic form of the affection the salicylates and salicylic acid may be employed as in acute articular rheumatism, care being taken not to disturb the digestion. In this type of purpura as well as in *purpura simplex* arsenic is indicated and should be given in increasing doses up to the limit of tolerance; irritation of the stomach, however, should be studiously avoided.

The hæmorrhages and the tendency to a diminution in the coagulability of the blood may be controlled by the administration of calcium lactate in 20 grain (1.33) doses three or four times daily. The dosage for a child should be regulated in accordance with the patient's age. Calcium chloride in similar doses may also be prescribed but is less efficient in increasing the coagulation of the blood than the lactate. It must be remembered that the administration of the calcium salts for more than three or four days at a time causes a diminished coagulability.

Of other remedies to check the bleeding, ergot, tannic and gallic acids, iron persulphate, dilute or aromatic sulphuric acid may be given in the usual doses. Oil of turpentine, 15 drops (1.0) three times a day, may be effective in some instances but in the calcium salts we have a means of increasing the coagulability of the blood and a method of controlling hæmorrhage which is much to be preferred to the administration of astringents or vaso-constrictor drugs. The hypodermatic administration of gelatin solutions has been suggested but is probably less effective than the method of treatment given above. These solutions as well as one of adrenalin chloride, when used as irrigations, often afford an excellent means of checking buccal and nasal hæmorrhages.

HÆMORRHAGIC DISEASES OF THE NEW-BORN.

Hæmorrhagic Syphilis of the New-born. The hæmorrhages may be congenital or they may appear within a few days after birth. Bleeding occurs from the navel and from the mucous membranes of the mouth and digestive tract. Hæmaturia may be observed, jaundice may appear. There is rapid emaciation and death usually follows within ten days. *Post mortem* examination reveals hæmorrhages and syphilitic disease of the viscera and other tissues.

Epidemic hæmoglobinuria or *Winckel's disease* may occur epidemically in maternity hospitals. A few days after birth, usually the fourth, the skin becomes bluish and jaundice appears, the temperature is elevated and gastro-intestinal symptoms with rapid pulse and respiration are noted. The urine is dark and contains albumin, casts and blood pigment (methæmoglobin). Death takes place in a few days or even within twelve hours. Upon autopsy the spleen may be found enlarged and, with the kidneys, is dark in color; the liver and heart may be the seat of fatty degeneration. Minute hæmorrhages may be present in the viscera. There is no sepsis of the umbilical vessels.

Acute degeneration of the viscera in the new-born or *Buhl's disease* differs from the condition just described in that fatty degeneration of the organs is a constant lesion.

Morbus maculosus neonatorum is a condition characterized by hæmorrhages from various tissues, particularly those of the digestive tract. The bleeding

usually appears during the first week of life but may be delayed to the second or third.

The hæmorrhage most commonly is from the intestine (*melæna neonatorum*) but may come from the nose, mouth, stomach or umbilicus. Hæmatogenous jaundice may be associated and there may be a febrile movement. *Post mortem* lesions such as are found in epidemic hæmoglobinuria do not occur but ulcerations of the digestive tract may be demonstrated. Death usually takes place within a week.

Treatment is usually unavailing but recoveries have been reported. The patient should be kept entirely at rest with the head low. The child should not be lifted even to be fed, this process being best carried on by means of a teaspoon or minim dropper, the mother's milk being employed. Warmth is absolutely necessary and the best means for providing an even warm temperature is the incubator. If this appliance is unavailable the child's couch may be suspended over hot water bags, heated bricks or flat irons. The proper temperature is about 90° F. (32.° C.). Stimulation by means of the hypodermatic administration of small quantities of whiskey is often indicated. The umbilical hæmorrhage may be controlled by the application of a pad of sterile gauze held in place by means of strips of adhesive plaster. Bleeding points which can be reached should be touched with stick silver nitrate or chromic acid. Nasal and mouth washes of adrenalin chloride solution may be employed and suprarenal extract in doses of 1 to 2 grains (0.065 to 0.13) every two hours may be given internally: 1 to 1½ ounces (30.0 to 45.0) of a sterilized 2 percent. gelatin solution may be given hypodermatically two or three times daily and are said to be beneficial. Gallic acid—1 grain (0.065)—may be given by the mouth and ergotine—1 grain(0.065)—may be given under the skin three times daily. Astringent injections are usually useless in the control of the hæmorrhages from the bowels for the bleeding, in most instances, is from lesions too far up in the digestive tract to be reached, but a half ounce (15.0) of a 5 to 10 percent. aqueous solution of calcium lactate or chloride may be given by the rectum in the hope that by its absorption the coagulability of the blood may be increased. These substances may also be given by mouth in small doses—1 to 2 grains (0.065 to 0.13)—with the same purpose in view. It must be remembered, however, that drugs should be given orally with the greatest care.

HÆMOPHILIA.

Definition. A constitutional dyscrasia, usually hereditary, and characterized by a tendency to persistent hæmorrhage, spontaneous or the result of injury.

Ætiology. The hereditary tendency to hæmophilia has long been recog-

nized. In rare instances the condition may be acquired. The hæmorrhagic diathesis may be transmitted from generation to generation and certain families are on record in which the condition has been present for as many as seven successive generations. The condition is more common in males than in females but is transmitted in most instances through the mother; thus the daughter of a bleeder, although herself unaffected, will usually give birth to progeny possessing the hæmophilic tendency, although in a large family of such children every one may not be a bleeder.

Hæmophilia is said to affect the Anglo-Saxon races much more commonly than the Latin, instances have, however, been observed in negroes. In the families of bleeders, which are often large, the offspring have an appearance of health, the skins are usually soft and fine and the coloring commonly is blond.

Pathology. The only abnormality which is constantly found in the blood is a delayed coagulation time. Sometimes vascular changes, such as a thinness of the walls of the vessels with fatty degeneration of the intima, are observed.

Symptoms. The condition usually manifests itself in childhood before the tenth year. It is brought to notice by the incidence of an obstinate hæmorrhage, often the result of slight injury, such as a small cut, the drawing of a tooth, etc. Umbilical hæmorrhage may be persistent in the new-born and fatalities have resulted from circumcision. In women menorrhagia is the rule; it is not, however, uncontrollable nor is post-partum hæmorrhage a feature of hæmophilia. The bleeding may take place from almost any part but epistaxis is most frequent; it may occur spontaneously or be precipitated by blowing the nose. Interstitial hæmorrhages are rare but in bleeders slight blows suffice to produce ecchymosis. Subjects have been observed in whom the tendency to hæmorrhage was in the neck and head only.

The bleeding is a slow capillary oozing and may continue for hours, even resulting fatally. When once stopped the patient's blood rapidly regenerates but frequent recurrences result in a secondary anæmia. Hæmatomata following traumatism are common.

Intra-articular hæmorrhages may be observed; they usually involve the larger joints, the affection being usually of acute development and evidenced by pain, swelling and a rise in temperature. At times there is permanent joint deformity and the condition may be mistaken for tuberculous arthritis.

The diagnosis in the presence of a family history is simple but one should be guarded in attributing any single obstinate hæmorrhage to hæmophilia. The diagnosis is justifiable only in the presence of successive hæmorrhages, spontaneous or otherwise, which resist the usual means of control. The association of arthritic manifestations is distinctly in favor of hæmophilia.

The prognosis is the most unfavorable in the subjects who give evidence

of the affection early in life; the condition, has, however, been outgrown in some instances. In the early instances death usually takes place before the eighth year. Hæmophilia is more serious in boys than in girls on account of the greater susceptibility of the former to injury.

Treatment. Prophylaxis lies in the protection of the hæmophilic subject from injury and in forbidding the marriage of the daughters of hæmophilic families. Surgical operations should be avoided.

Hæmophilic subjects should regulate their lives in the strictest accordance with the rules of hygiene. Diet and exercise in the fresh air are important and any anæmic condition should be combated by the administration of iron, arsenic and other tonics.

When a hæmorrhage occurs the patient should be put to bed and kept absolutely at rest and calcium lactate in doses of 20 grains (1.33) thrice daily should be prescribed. In this substance we have an active means of increasing the coagulability of the blood but its use should not be continued too long, for after a certain time it reaches its maximum effect and from then the coagulability becomes lessened. Calcium chloride may be employed in the same dosage but is less satisfactory. Compresses should be applied to the site of the hæmorrhage; these may be moistened with 1 to 1,000 adrenalin chloride solution or the bleeding surface may be powdered with dried suprarenal extract. The local application of 5 or 10 percent. gelatin solution has been suggested and the subcutaneous injection of a pint (500.0) or more of the same has its advocates. Other local hæmostatics such as tannic and gallic acids, hydrogen dioxide, solutions of iron perchloride or persulphate may be employed. In epistaxis, before packing the nares, the topical use of adrenalin chloride solution 1 to 1,000 and the inhalation of carbon dioxide gas may be tried.

Upon internal remedies other than the calcium salts little dependence is to be placed; ergot may be tried, tincture of ferric chloride ½ drachm (2.0) every two hours has been recommended and ergotine may be given hypodermatically.

The after treatment of the hæmorrhage consists in the employment of the means indicated in the management of secondary anæmia.

CHAPTER VI.

DISEASES OF THE DUCTLESS GLANDS.

DISEASES OF THE SPLEEN.

Primary splenic disease is a very rare condition, most of the affections of this organ being associated with other morbid states and are considered under the discussion of the diseases to which they are secondary, such as malaria, affections of the blood, hepatic and cardiac diseases, etc. Certain splenic conditions, however, remain which should be described by themselves.

THE WANDERING SPLEEN.

Synonyms. Floating Spleen; Dislocation of the Spleen; Movable Spleen.

This condition is the result of elongation of the peritonæal folds which normally hold the organ in place and of elongation of the splenic vessels. It may occur as a part of a general visceroptosis, as a result of tight lacing, traumatism, or of increase in size and weight of the organ. The displaced spleen may be found in almost any part of the abdominal cavity and has even been observed as part of the contents of an inguinal hernia.

Symptoms. The symptoms may be indefinite, consisting of a dragging sensation in the abdomen; pressure symptoms are not infrequent. The tumor may impinge upon the bladder or ureter and cause difficulty in urination; pressure upon the stomach and intestine may result in digestive disorders or partial obstruction. The nervous syndrome which is observed in instances of visceroptosis may occur. Torsion of the pedicle of the organ leads to swelling, fever and even necrosis.

Physical examination reveals the presence of a movable (unless the spleen has become fixed by adhesions in an abnormal position) abdominal tumor, the shape of which corresponds to that of the spleen and whose edge is sharp and notched. More or less enlargement of the displaced organ is common. Percussion over the normal splenic area shows an absence of dulness.

The prognosis as to life is good. Twisting of the pedicle or intestinal obstruction due to pressure are serious considerations.

Treatment. When the splenoptosis is a part of a general downward displacement of the viscera the treatment is that of the latter condition. Simple wandering spleen may often be held in place by means of a properly fitting pad and abdominal belt.

The operative treatment by means of splenectomy has given good results but is not to be undertaken without due consideration since enormous hæmorrhages are apt to occur during and after operation. A less radical procedure is opening the abdomen, replacing the spleen and holding it in position by means of gauze pads until permanent adhesions have taken place. The pads may then be removed and the abdominal wound closed.

PERISPLENITIS.

Perisplenitis may result from extension of inflammation of adjoining structures such as the stomach, diaphragm, peri-renal tissue or from traumatism. Adhesions result and pain upon respiratory movements may distress the patient. Crepitus over the spleen may be detected upon palpation.

Treatment. The pain may be relieved by the various forms of mild counter-irritation and the inunctions of 10 percent. of iodine in vasogen.

SPLENITIS.

Primary inflammation of the spleen is rare; splenitis secondary to inflammation of adjacent organs, such as the stomach or intestines, may take place by extension. Traumatic splenitis may occur and the acute hyperplasia of the organ due to malarial fever, typhoid infection, etc., may be considered as an inflammation of the viscus.

The principal symptoms are enlargement and tenderness associated with affections of neighboring structures or occurring in the course of one of the infections.

Physical examination reveals the presence of the typical splenic tumor. When the organ is not palpable splenic dulness extending below Luschka's lines, which are drawn one from the posterior superior iliac spine to the nipple, the other from the umbilicus tangent to the lower border of the eleventh rib, gives evidence of increase in size.

Treatment consists in the proper management of the primary condition. Ergot in drachm (4.0) doses of the fluidextract three or four times a day, given until there is perceptible arterial hypertension, will cause a contraction of the organ. The administration of this drug preliminary to the exhibition of quinine in chronic malarial enlargement is an excellent measure. Iodine may be prescribed preferably as the syrup of hydriodic acid, 1 drachm (4.0) three times daily to be taken on an empty stomach and well diluted.

ABSCESS OF THE SPLEEN.

Abscesses of the spleen are usually metastatic, occurring in general pyæmic infections or in malignant endocarditis. Simple splenic infarct, which may

be the result of the lodgment of a non-septic embolus from a valvular vegetation in endocardial disease, may subsequently become infected and cause suppuration. Splenic abscess may also result secondarily from the extension of inflammation of neighboring structures or from traumatism. Infective infarcts may also occur in such acute diseases as enteric fever.

The symptoms of splenic suppuration are pain and tenderness referred to the organ, enlargement and a temperature of septic type. Abscesses of the spleen may rupture into the general peritonæal cavity. The rupture is evidenced by sudden pain, prostration and abdominal tenderness. When the rupture takes place into the stomach pus and blood may be vomited.

Treatment is surgical and consists in free incision and drainage.

RUPTURE OF THE SPLEEN.

This accident may be caused by severe traumatism or occur as a result of marked congestion associated with enteric fever. It may also be due to rapidly growing malignant tumor of the organ and has been known to follow exploratory puncture.

The symptoms are severe sudden pain, collapse and pallor, resulting from the hæmorrhage. Death takes place within a short time unless immediate operation, with a view to controlling the hæmorrhage, is undertaken.

THE AMYLOID SPLEEN.

Synonym. Sago Spleen.

The amyloid spleen develops in association with amyloid degeneration of the other viscera and is met as a result of prolonged wasting disease such as chronic tuberculous inflammation of the lungs or osseous system, chronic entero-colitis, syphilis and protracted suppurative processes generally. The organ is enlarged, hard, smooth and firm; its edge is rounded.

The symptoms are those of the causative disease, of amyloid degeneration of other viscera with emaciation, weakness and splenic enlargement.

The condition is a serious one and its treatment is that of the underlying affection.

NEOPLASMS OF THE SPLEEN.

The most common of these are syphilitic gumma and tuberculoma. Cysts, echinococcus and of other types, as well as secondary carcinoma and sarcoma have been observed. The condition is often unrecognized during life. The spleen is enlarged and its surface may be nodular. The diagnosis depends upon the presence of associated lesions. Such a spleen as that above described

occurring with gastric cancer may be attributed to carcinomatous growths; in the presence of sarcomatous tumors elsewhere it is probably sarcomatous; when observed in connection with specific disease it may be considered as syphilitic.

ECHINOCOCCUS CYSTS OF THE SPLEEN.

Echinococcus infection of the spleen occurs in connection with similar disease elsewhere in the body. The organ usually presents a fluctuating tumor the character of which cannot be definitely determined when unassociated with echinococcus disease in another organ, or unless the characteristic hooklets are demonstrated in the aspirated fluid. Abscess, in which a fluctuating enlargement of the spleen may be detected, is associated with the typical temperature of pyogenic infection.

SPLENIC ANÆMIA.

Synonym. Splenic Pseudo-leucæmia.

Definition. An anæmia characterized by enlargement of the spleen and to be differentiated from Hodgkin's disease and leucæmia by the absence of increase in the size of the lymphatic glands.

Ætiology. While the definite cause of the affection is unknown it is believed that the infectious diseases and intestinal infection may be predisposing factors in its occurrence.

Pathology. The spleen is greatly enlarged, often to several times its normal size; its shape is not affected. Perisplenitis with capsular thickening is often present and adhesions to adjacent structures may be observed. Upon section the organ is found to be more dense than normal owing to increased connective tissue which may even replace the Malpighian bodies. Sclerosis of these elements is characteristic of the disease. Changes in the marrow analogous to those met in pernicious anæmia may be noted. Thrombosis of the splenic vein may be present.

Symptoms. These are a gradually increasing pallor, dyspnœa, palpitation, progressive weakness and enlargement of the spleen. The patient ultimately becomes cachectic, the skin is yellow, and fever, dropsy of the subcutaneous tissue and of the serous cavities may appear. Hæmorrhages are not unusual.

The blood contains a relatively high number of red cells as a rule (3,000,000 to 3,500,000). The hæmoglobin percentage is lowered; the leucocytes are are not increased but a relative lymphocytosis may be present. In the late stages of the disease poikilocytosis with normoblasts and megaloblasts may be observed in rare instances.

The diagnosis is distinctly difficult but the striking features of the condition are the anæmia, preceded by the splenic enlargement and the absence of increase in the size of the lymph nodes, with a diminished or normal number of leucocytes, a tendency to hæmorrhages, particularly from the gastro-intestinal tract, and a protracted course.

The prognosis is uniformly unfavorable but the patient may survive for several years.

Treatment. The patient's nutrition should be maintained by plenty of good food and the other means indicated in the more ordinary types of anæmia. Arsenic, iron and bone-marrow may be prescribed.

When the splenic enlargement is marked and the hæmorrhages are severe and frequent the operation of splenectomy may be considered; about 75 percent. of recoveries are said to have followed this procedure.

BANTI'S DISEASE.

This is a rare affection characterized by enlargement of the spleen, subsequent anæmia and secondary hepatic cirrhosis of atrophic type with jaundice, ascites and other symptoms of this lesion. The anæmia is analogous to that of chlorosis and there are no especial leucocytic changes. Necropsy has revealed chronic splenitis with interstitial changes in the liver and sometimes an increased redness of the bone-marrow.

The course of the disease is protracted, lasting ten years or even longer.

The indications for treatment are practically identical with those in splenic anæmia.

PSEUDO-LEUCÆMIA.

Synonyms. Hodgkin's Disease; Lymphatic Anæmia; Lymphadenosis; General Lymphadenoma.

Definition. An affection characterized by enlargement of the lymphatic glands and spleen, the appearance of lymphatic growths in the lungs, liver, spleen and other organs and a consequent secondary anæmia.

Ætiology. The causation of this disease is unknown. It is most frequently observed in males before the incidence of middle life. It may occur in children. In numerous instances the cervical glands are first involved following some buccal or pharyngeal irritation, which fact has given rise to the theory that the affection is due to an infection which effects its entrance through the structures drained by the cervical lymphatics.

The hypothesis that tuberculous infection is responsible for Hodgkin's disease is disproven by the facts that the tubercle bacillus is not constantly found in the lesions, that inoculation experiments and the tuberculin test may be negative in typical instances of the affection and that the pathological

changes in the glands are distinctive and characteristic. Tuberculosis may, however, become engrafted upon the enlarged glands of the disease.

Pseudo-leucæmia is likewise to be separated from malignant adenoma by the absence of the characteristic histologic appearances of cancer.

Pathology. The enlargement involves first the superficial groups of lymph nodes, those of the neck often showing increase in size before there is noticeable affection of those of the axilla and groin. Later the deep glands, those of the retro-peritonæal, bronchial and other groups, are at times so markedly increased in size as to cause abdominal enlargement or respiratory difficulty. Pressure upon the trachea, œsophagus, thoracic vessels, ureters, and lumbar nerves may occur. At first the diseased lymph nodes are soft but later become hard and firm; they often tend to fuse and they seldom become adherent to neighboring structures. When cut the section is grayish white and, if the gland is soft, a whitish fluid exudes; the hardened glands are firm under the knife and show fibrous trabeculæ.

Splenic enlargement is present in a large majority of instances and is of the hyperplastic type. It is often considerable but less extreme than in leucæmia.

The marrow of the long bones is sometimes converted into lymphoid tissue and may be much softened.

Lymphoid growths are present in the spleen in more than 50 percent. of the patients and these may occur in the liver, which at times is found enlarged, the kidneys, the lungs and other organs and tissues. Even the nervous system may be invaded and the lymphoid structures in the pharynx often undergo marked increase in size.

Symptoms. The first of these is usually an enlargement of the cervical lymph nodes which often follows an inflammation of the tonsils or pharynx. Rarely the deep glands are first involved. Later, but perhaps not for months or even years, the axillary and inguinal glands are affected. The enlargement may cease for a time and later begin again. The glands usually are soft, discrete and very seldom are painful or tender. Late in the disease they may become hard and firm.

The spleen is usually enlarged and the lymphoid growths upon the surface of this organ and the liver may be palpable.

As the affection progresses the patient becomes anæmic, is pale, and complains of weakness, vertigo, palpitation and dyspnœa.

Pressure symptoms often become evident; the axillary enlargement causing pain in the arms and hands, by reason of pressure upon the nerves, and œdema due to interference with the circulation. Analogous manifestations are observed in the lower limbs resulting from the inguinal enlargement. Pressure upon the bronchi or trachea causes cough and dyspnœa. Transudates may appear in the serous cavities and pupillary disturbance from pressure upon the sympathetic may be noted. Involvement of the vagus may cause

a disturbance of the cardiac action. The skin may become bronzed; crops of furuncles and pruritus have been noted.

The temperature in the early stages is irregularly elevated from time to time to a slight degree; later there is a more marked febrile movement, a daily ascent of several degrees with chills and perspiration, being not unusual. Rarely paroxysms of fever occur lasting for a week or two. These appear at intervals, the temperature during the intervening periods remaining normal; coincident with the fever there may be a rapid enlargement of the glands which, to some extent but not wholly, disappears during the afebrile period. Such febrile paroxysms have been attributed to recurring infection.

The late stages of the disease are marked by extreme weakness and emaciation; general œdema is sometimes present.

The blood shows a moderate anæmia of chlorotic type, the number of red cells being relatively high while the hæmoglobin percentage is low. Changes in the form of the red cells are not constant nor marked. The leucocytes usually show no characteristic change in number or in type. In some instances a relative lymphocytosis has been observed; an *ante mortem* leucocytosis has also been described.

The diagnosis should be made with care, there being several conditions which resemble Hodgkin's disease sufficiently to render mistakes easy.

Glandular tuberculosis may be differentiated by the greater tendency of the glands to coalescence and suppuration. The tuberculin test should be employed and, if necessary, a portion of the involved tissue may be excised and examined microscopically.

Malignant disease is more likely to be limited to a single group of glands and the neighboring structures are as a rule invaded; microscopical examination of a section of the tumor will confirm the diagnosis. In lymphosarcoma the lymphocytes are usually considerably increased unless there is involvement of the entire lymphatic apparatus, when these elements are greatly reduced as a result of the disease of the tissues which form the lymphocytes.

Leucæmia may be differentiated from Hodgkin's disease by blood examination and by histological examination of the glandular tissues which are affected.

The prognosis is distinctly unfavorable but the course of the disease is not constant. Certain instances, in which the evolution of the lymphoid enlargements is rapid, may terminate fatally in a few months but the average duration of life after the onset of the disease is about two years. Temporary periods of remission during which all the symptoms become ameliorated, the swellings diminish and the patient shows marked improvement, are not uncommon.

Treatment. The general management of this affection as regards hygiene, diet, etc., is identical with that of leucæmia. Tonics such as iron, strychnine

and codliver oil are often very useful. Bone-marrow may be prescribed. Arsenic, however, seems to be the most effective drug at our disposal. Under its administration the glandular swellings often diminish, the condition of the patient is markedly changed for the better and the course of the disease is retarded even if recovery does not ensue. It may be given in the form of Fowler's solution of potassium arsenite—in increasing doses, beginning with 3 or 4 minims (0.2 to 0.25) thrice daily after eating. It should be well diluted. The dose is increased each week by 1 minim (0.065) until the patient is taking 20 to 30 minims (1.33 to 2.0) thrice daily. Upon the appearance of gastric disturbance the drug should be stopped and later resumed. In the meantime we may inject the Fowler's solution directly into the glandular tumor. The proper amount is slightly less than that to be given by mouth, diluted with an equal amount of sterile water. Arsenic administered in this way is said to be very effective. Sodium dimethyl arsenate and disodium methyl arsenate may also be employed as suggested in the section upon the treatment of pernicious anæmia.

Inunctions of 10 percent. iodine in vasogen or of potassium iodide may have some influence upon the glandular enlargements and the administration of phosphorus has been suggested. Berberine sulphate is advised upon the ground that it betters the general condition, increases the appetite and lessens the tendency to increase in size of the spleen. Its dose is from $7\frac{1}{2}$ to 15 grains (0.5 to 1.0). It may be prescribed in powder mixed with milk sugar or in pills each containing 3 grains (0.2) of berberine sulphate and 2 grains (0.13) of extract of gentian. Of these three should be taken thrice daily.

Symptomatic cures have been reported as resulting from Röntgen ray treatment and improvement is said to take place in many instances. A relatively hard tube should be used and is so excited as to give a light penetrating enough to reach the diseased tissues. The ray is applied to the enlarged glands, the spleen, the chest, elbows and knees, care being taken to avoid burns, and the organs of generation being protected by an opaque screen. The number, intervals and duration of the treatment are to be regulated in accordance with the effect produced.

When the lymphoid enlargement involves the neck only, particularly if the glands of only one side are affected, excision of the tumors is considered advisable and may delay the progress of the disease.

STATUS LYMPHATICUS.

Synonym. Lymphatism.

Definition. A rare affection characterized by a hyperplasia of the various lymphoid structures and tissues of the body, including the lymph nodes, the spleen, the thymus gland and the lymphoid marrow of the bones.

Ætiology. The condition is chiefly observed in children and adolescents; nothing definite is known of its causation.

Pathology. The lymphoid tissues of the pharynx and the lymph glands of the chest and abdomen are most frequently involved; the superficial lymph nodes are seldom affected. Enlarged tonsils and adenoid growths are common and the solitary and agminated glands of the intestine are often greatly increased in size. The splenic hyperplasia is not particularly marked, the consistency of the organ is soft and the Malpighian corpuscles are distinct. Enlargement of the thymus gland is the rule, the structure is soft and upon its cut surface a milky fluid may appear. The marrow of the long bones may be in a condition of hyperplasia and red marrow may replace the yellow.

Associated lesions in certain instances are cardiac and aortic hypoplasia and rickets.

The chief point of interest concerning the status lymphaticus is its tendency to association with sudden death from apparently inadequate causes such as short chloroform or æther anæsthesia, or the injection of a dose of diphtheria antitoxin. Instances of sudden death while bathing, or upon falling into the water although immediate rescue has taken place have also been attributed to lymphatism. The so-called "Thymus Death" of the Germans has been considered a result of this condition and persons who have died suddenly during the convalescent period of the acute infections have sometimes been thought to have possessed this affection.

The status lymphaticus has been considered to be associated with a condition of intermittent lymphotoxæmia or due to excessive production of the secretion of the thymus gland and it has been supposed that the sudden death is probably the result of such toxæmia or occurs as a result of toxic, physical or psychic injuries which are predisposed to by the already existing lymphotoxæmia.

The recognition of the condition is often difficult but in general it may be stated that it is characterized by a pale and pasty skin, a considerable amount of subcutaneous fatty tissue, hypertrophy of the superficial lymph glands, especially those of the cervical and axillary groups, enlargement of the tonsils, and the presence of pharyngeal adenoids. The patient is often rickety and there may be enlargement of the spleen and of the thymus gland. Hypertrophy of the deep lymph nodes is less frequent than that of the superficial groups and cardio-vascular hypoplasia is very inconstant, although the statement has been made by Quincke that dilatation of the left ventricle and a shrunken condition of the peripheral arteries may be observed.

Treatment. This is based upon the underlying conditions. Individuals in whom the condition is suspected should not be subjected to general anæsthesia. If surgical operations are necessary they should be done under the influence of cocaine or some analogous drug.

DISEASES OF THE THYROID GLAND.

SIMPLE GOITRE.

Synonyms. Bronchocele; Struma.

Definition. A non-inflammatory enlargement of the thyroid gland occurring sporadically or endemically.

Ætiology. The cause of simple goitre is unknown but it has been thought that the endemic type of the affection may be due to some constituent of the drinking water. Goitré is much more common in women than in men both in its sporadic and endemic forms and the most common time for its development is shortly after the onset of puberty. In some instances the swelling does not appear until the incidence of the menopause. Heredity may have some influence in its production and congenital instances have been observed.

In the United States endemic goitre is infrequent but the condition is not rare in regions about the eastern shore of Lake Ontario, Michigan and certain mountainous districts in Pennsylvania. It is very common in certain parts of Switzerland, France and Italy and may occur in connection with cretinism. In Derbyshire, England, it is observed and a large proportion of the inhabitants of some portions of central Asia are affected with the disease.

An acute epidemic form of goitre has been described as breaking out in schools and garrisons, persisting for a few months and then subsiding.

Patients afflicted with sporadic goitre are quite frequently seen.

Pathology. Simple goitre begins as a hypertrophy of the parenchyma of the gland but as the enlargement develops certain peculiarities appear resulting in goitres of various types: *a. Parenchymatous goitre* in which the increase in size affects all the elements of the gland uniformly. *b. Vascular goitre* in which the enlargement is chiefly the result of dilatation of the blood-vessels. *c. Cystic goitre* in which the follicles become enlarged and contain fluid and in which calcareous degeneration of the walls is frequent; *d. Fibrous goitre* which is characterized by increased growth of connective tissue. *e. Colloidal goitre* in which the enlarged follicles are distended with colloid substance. Combinations of these varieties are not uncommon.

Symptoms. When small, goitrous enlargements usually cause no symptoms; large goitres cause symptoms which are chiefly the result of pressure upon neighboring structures. Pressure upon the trachea causes difficulty in breathing, upon the œsophagus interference with deglutition. Extension of the tumor behind the sternum may compress the veins draining the head and neck, and cause swelling of these parts, with vertigo or headache. Rarely there may be pressure upon the vagus resulting in paralyses of the vocal cords or glottic spasm. Sudden death has been observed in rare instances and has been attributed to pressure upon the pneumogastric nerve or hæmorrhage.

Examination reveals a tumor of varying size which rises with deglutition and involves either the entire thyroid gland, one or both lateral lobes or the isthmus alone. In cystic goitre, fluctuation of the fluid contents of the cysts may be detected and in the vascular type pulsation may be present.

Treatment. In goitrous regions only boiled water should be drunk and, if possible, a change of climate should be advised; even after the appearance of the tumor recovery has been observed upon removal to a non-goitrous district.

Iodine externally and internally seems to have more influence upon the size of the tumor than any other drug. It is given by inunction into the tumor in the form of the official iodine ointment, as the ointment of red mercury iodide or in an ointment consisting of 1 part of iodine, 10 parts of potassium iodide to 100 parts of lanolin or lard; 10 percent. iodine in vasogen is also suggested as an inunction. Internally the tincture of iodine in doses of from 3 to 10 minims (0.2 to 0.66) may be prescribed; it should be taken twice a day after eating and diluted with simple syrup. Potassium iodide in doses of from 10 to 20 grains (0.66 to 1.33) or the syrup of hydriodic acid in doses of 1 drachm (4.0) in a wine glass of water before meals may prove useful.

The injection of iodine, 15 to 30 minims (1.0 to 2.0) of a 10 percent. alcoholic solution, into the substance of the gland has been suggested. The procedure may be carried out two or three times per week. Iodoform injections have been practised and are particularly indicated in the cystic type of the affection; the cyst contents having been drawn off by means of an aspirating needle, 30 minims (2.0) of a solution containing 15 grains (1.0) of iodoform, $1\frac{3}{4}$ drachms (7.5) each of æther and sterile olive oil are injected at intervals of from one to two weeks.

In vascular goitre, ergot in increasing doses may be administered and belladonna has also been suggested.

The organotherapy of goitre has been advocated with enthusiasm and has proved beneficial in some instances. The extract of the thyroid gland may be given in doses of from 3 to 5 grains (0.2 to 0.33) thrice daily or the fresh thyroid of the sheep chopped and spread upon bread may be prescribed; 75 to 150 grains (5.0 to 10.0) of the gland being given twice weekly.

The use of electricity may be tried in recent goitrous swellings of the hyperplastic type. A needle attached to the negative pole is inserted into the gland, the positive pole, to which a sponge electrode is fitted, being applied to the skin of the adjacent parts. The galvanic current is employed and the resulting electrolysis may diminish the size of the tumor.

Surgical treatment is indicated when the tumor has become so large as to cause distress by its pressure or disfigurement. The entire gland may be excised if desired but there is always the possibility of resulting myxœdema or *cachexia strumipriva*. In vascular goitre particularly, the ligation of the

thyroid arteries has been advised. Other surgical procedures which may be undertaken are partial thyroidectomy, incision of the isthmus, and evacuation of the contents of cysts followed by the injection into their cavities of iodine or iron chloride solutions.

CONGESTION OF THE THYROID GLAND.

Congestion of the thyroid gland is often observed in girls at puberty and there is frequently a temporary enlargement coincident with the menstrual period. Such enlargement is extremely rarely permanent. Increase in the size of the organ has also been observed as a result of violent and prolonged weeping, wearing too tight collars and the over-use of the voice.

ACUTE THYROIDITIS.

Acute thyroiditis, general or confined to one lobe of the gland, is evidenced by acute swelling, tenderness and redness. Rarely suppuration may follow with destruction of the organ and resulting myxœdema.

This affection is seldom primary but is a not very infrequent complication of the acute infectious diseases, especially enteric fever, scarlatina, diphtheria and pneumonia. Exophthalmic goitre has been observed as a sequela.

EXOPHTHALMIC GOITRE.

Synonyms. Graves' Disease; Basedow's Disease; Parry's Disease.

Definition. An affection characterized by enlargement of the thyroid gland, protrusion of the eyeballs, rapid pulse and tremors.

Ætiology. The disease is much more frequent in women than in men and is most often observed in young and middle-aged adults. Instances have been reported in early childhood and in old age. Heredity has some influence as a predisposing factor and the condition seems more likely to affect those of neurotic tendency. It has been known to follow such acute infections as enteric fever and rheumatism. The theory that exophthalmic goitre is the result of intestinal auto-intoxication has been advocated in the past, but the hypothesis that the disease is a specific toxæmia due to hyperthyroidism or excessive production of the secretion of the thyroid gland or of certain elements contained in this secretion, is the most recent and the results of experimentation seem to prove that this is the true cause of the affection, and that it is the antithesis of myxœdema which is due to lack of proper function of the thyroid.

Pathology. The changes which occur in the thyroid gland in exophthalmic goitre are indefinite, various chronic lesions, however, have been found,

all of which are of such character as to render the hypersecretion theory tenable. Persistence of the thymus gland is not unusual and changes in the muscles, probably occurring as a result of the toxæmia, may account for the extreme muscular weakness which is characteristic of the disease.

Symptoms. Both acute and chronic forms of exophthalmic goitre are described; in the former the onset of the disease is very rapid with pronounced exophthalmos, greatly increased heart action, thyroid enlargement and persistent vomiting and diarrhœa. Cerebral symptoms are not usual but delirium appears in some instances. This type of the affection may prove fatal within a few days.

The chronic type of the affection is usually of slow development. The characteristic symptoms are four in number.

1. *Rapid heart action* is constant and, as a rule, extreme, the pulse rate often reaching, in the more advanced stages of the disease, 100 beats per minute or even more. Emotion augments the pulse rate to a marked degree. Irregularity is not infrequent, there may be pulsation in the vessels of the neck and visible pulsation of the superficial arteries and of the capillaries is often present. Physical examination reveals a forcible apical impulse which is in marked contrast to the weakness of the pulse. The apex beat is not displaced but late in the disease may be diffuse. Percussion may show cardiac enlargement due to a secondary hypertrophy and dilatation. The heart sounds may be audible at a distance from the patient; apical ventriculo-systolic murmurs are common and are due to a relative mitral insufficiency; basic murmurs of soft blowing character, usually occurring with the first sound, are common. There is frequently an accentuation of the sounds due to valvular closure. Acute dilatation may supervene, accompanied by dyspnœa, cough and the expectoration of blood-stained froth.

2. *Exophthalmos* is common; it may not develop until some time after the incidence of the cardiac symptoms and it varies in degree in different patients and even from time to time in the same subject. It may be slight, even hardly discernable, or very extreme, instances of entire dislocation of the eyeball having been observed. The patient winks more seldom than in health; the pupil and the vision are unaffected. Optic nerve changes are not common but retinal pulsation is often observed. Disturbances of convergence may occur. In marked instances of exophthalmos the eyelid does not follow the movement of the eyeball when the latter is moved downward (von Græfe's sign). This is characteristic but not constant. Retraction of the upper lid resulting in widening of the palpebral fissure is common (Stellwag's sign). Spasm of the levator palpebræ superioris may occur (Abadie's sign).

3. *Thyroid enlargement* usually appears with the exophthalmos; the increase in size is usually not extreme. The enlargement may be uniform or localized and may vary with changes in the circulatory function. The gland may be

felt to pulsate and a thrill may be palpable, auscultation often reveals a loud ventriculo-systolic *bruit;* a double murmur may be detected and is said to be pathognomonic.

4. *Tremor* (Marie's sign) is the final symptom of the tetrad; it may appear early or not until late in the disease. It is observed when the patient holds out his hand in the prone position. The entire hand moves, the muscles of the wrist being the ones affected; the fingers do not vibrate independently. The tremor is fine and of small extent; its rate is about eight or nine times per second. Rarely the foot or even the entire body may be involved.

There are various other manifestations associated with the four cardinal symptoms. Muscular weakness and painful cramps are not uncommon; even muscular atrophy has been observed. Flushing of the skin with intermittent sweating is frequent and pruritus and pigmentation may occur. A brawny œdema of various parts is often noted and excessive micturition may take place; glycosuria and albuminuria may complicate the disease. Rapid breathing with dyspnœa, sometimes accompanied by cyanosis, is not rare, and marked diminution in the cutaneous resistance to electricity has been described by Charcot. Mental symptoms, such as excitability, depression, melancholia and mania are not unusual and such complications as epilepsy, hysteria and chorea have been noted. Symptoms referable to the digestive tract such as those which usually usher in the acute type of the disease may occur from time to time in the chronic form.

Attacks, which strongly indicate the probability of the toxic origin of the affection, take place in most serious types of the disease and in fatal instances they are a very constant manifestation; they are frequently induced by the incidence of some mild affection such as tonsillitis, bronchitis or influenza, and consist of definite febrile exacerbations, associated with acute cardiac dilatation, increased intensity of the existing murmurs or the appearance of new ones, extreme tachycardia and cardiac distress, digestive disturbances, such as abdominal pain, vomiting or diarrhœa, sweating, dyspnœa, restlessness and sleeplessness, erythema of the skin and œdema of the extremities. The theory is that such exacerbations of symptoms are the result of a specific toxæmia due to hyperthyroidism.

The diagnosis in well-marked instances is extremely simple. In the masked form of the disease difficulty may be experienced, for at times the rapid heart action and tremor may be present without thyroid enlargement; later, however, the goitre may appear and remove the doubt.

The prognosis is usually good as to life but recovery is rare in patients in whom the disease is well marked and has persisted for a considerable period. Spontaneous cure sometimes takes place in the mild forms. Acute instances of the disease and acute exacerbations of the chronic type of the affection may result fatally within a short time; yet patients in whom the attack appeared

suddenly and gave evidence of great severity have gone on to recovery within a few days.

Treatment. The importance of absolute rest cannot be too strongly emphasized; the patient should be put to bed and strict quiet enjoined, the application of an ice coil to the chest and the administration of cardiac sedatives, veratrum viride or aconite, will lessen the cardiac irritability, while the nervous excitability should be controlled by means of the bromides. Digitalis and strophanthus have been advised upon account of their action in slowing the pulse rate but these drugs, and aconite and veratrum viride as well, should be given with great care. The use of ergot has been advised and good results have followed its use in combination with strychnine and digitalis; the same is true of belladonna and sodium phosphate. Relief is said to have followed the administration of sodium salicylate in doses of 10 to 15 grains (0.66 to 1.0) 3 or 4 times daily and 20 grain (1.33) doses of sodium glycerophosphate given at similar intervals, are recommended.

Treatment by means of thyroid extract or by ingestion of the gland itself has been tried but has proved unsuccessful save in instances where there have been myxœdematous manifestations. Suprarenal extract has been employed and has proved sometimes beneficial, and the same may be said of thymus extract.

Electricity has given good results in some instances and the use of both the faradic and galvanic currents as well as of the sinusoidal current, has been advocated. Faradic electricity has been employed as follows: the positive pole is placed in the nuchal region while the negative pole is applied to the sterno-mastoid muscle at the angle of the jaw, thence it is moved to the middle of the muscle, the application being continued for about a minute on each side of the neck; the negative electrode is then applied to the eyelids and around the margin of the orbits for about two minutes for each eye, the infra- and supra-orbital nerves being avoided. A plate electrode is then substituted for the olive shaped one previously employed and is placed over the thyroid tumor and allowed to remain for about five minutes. This form of treatment should be continued for from six months to a year.

The galvanic current is believed to exert a more active effect upon the glandular secretion and has given good results in the hands of some observers. The technique is variable but as a rule the negative electrode is applied to the region of the thyroid and the positive to the back of the neck. The strength of the current may vary from 25 to 60 milliamperes. Guilloz moistens the negative electrode with a solution of potassium iodide.

A combination of faradization and galvanization may be employed, a large plate electrode being applied to the thyroid region and the positive electrode is placed at the back of the neck. A galvanic current of 15 to 30 milliamperes is used and the faradic current is given to the limit of the patient's toler-

ance. In some subjects this treatment brings about a marked amelioration within two or three months, the general irritability being lessened, together with the sense of oppression and the diarrhœa, and the goitre diminishing in size. The tachycardia and the tremors react more slowly.

Quick and permanent results are said to follow the use of the sinusoidal current, the patient being placed in a bath of water, the whole body surface thus receiving the benefit of the treatment.

The electricity is supposed to be favorable in that it excites the rapid elimination of the thyroid toxins and that the treatment also has a certain mental effect upon the patient through suggestion.

The Röntgen rays have been used in the treatment of exophthalmic goitre in various ways. In the milder types of the affection they may be employed energetically in connection with regulation of the patient's general hygiene; in the severer instances of the disease, after the extirpation of a portion of the gland, the exposures are begun as soon as the wound has well united. The exposure of the gland to the influence of the rays for twelve minutes every four to seven days has caused a complete disappearance of the thyroid tumor in at least one instance.

Tubes containing radium have been inserted into the incised gland for a period of fifteen minutes and after several weeks of the treatment a diminution of the tumor has been observed but the tachycardia has persisted.

Upon the toxæmic theory as a basis numerous experiments along the line of treatment by means of the blood or serum from thyroidectomized animals have been undertaken and some of these have produced rather remarkable results. The serum appears to be preferable to the blood since it is more active and less repugnant to the patient. The serum may be either that of the goat or the sheep; the best results are said to be obtained, however, from that of the latter. The animals operated upon should be between the ages of two and five years. The thyroid is wholly excised but the parathyroids are left in place. The blood is first drawn by means of jugular puncture about three or four weeks after operation; the serum is filtered and rendered absolutely sterile; the addition to it of antiseptics such as phenol does not seem to impair its efficiency. The dosage varies from 35 to 45 minims (2.33 to 3.0) every two days depending upon the patient's condition, and the serum is taken in water or wine. The serum is continued in this dosage for from three to four weeks; it may then be discontinued for a week and later resumed for two weeks in each succeeding month. The entire duration of the treatment is variable but usually is from six months to a year, the periods of intermission being lengthened as the patient improves. Under the influence of the serum the size of the thyroid, the exophthalmos, the tachycardia and the tremors diminish progressively. After the establishment of cure it is best to advise the patient to take the serum for about fifteen days during each following year.

The milk of thyroidectomized animals has also been employed as a means of treatment, but, while to a certain extent effective, is inferior to the serum.

Very recently most remarkable results have been reported from the administration of a cytotoxic serum produced by passing an extract of the thyroid gland of human beings who have died while afflicted with exophthalmic goitre through the blood of living rabbits; from these a serum is derived containing both a cytotoxin and an antitoxin. This serum when injected in doses of $7\frac{1}{2}$ to 30 minims (0.5 to 2.0) into patients suffering from exophthalmic goitre, especially those who exhibit the symptoms of febrile exacerbations, produces a most extraordinary reaction. Although for the first few days after administration the serum may seem to accentuate the symptoms, a general improvement, even recovery, takes place, in most instances, oftentimes only two or three doses being necessary to cause this effect. The only untoward effect of this treatment seems to be an erythema, not only at the site of the injection, but upon remote parts of the body. The work done by Rogers and Beebe upon this serum bids fair to revolutionize our theories concerning the origin and management of exophthalmic goitre. The only drawback to this method of treatment would seem to be the manifest difficulty of obtaining diseased human thyroid glands, for experiments of analogous character have been undertaken with extracts of the healthy human gland, and, while not wholly negative, have been by no means so remarkable in their results as those with the extract of the thyroid gland of exophthalmic goitre.

The surgical treatment of the disease must be considered in the event of the failure of treatment by other means. Ligation of the thyroid arteries is productive of benefit in some instances and bilateral sympathectomy may produce good results in that the consequent ptosis will diminish the exophthalmos; entire recoveries have been reported as due to this operation. It appears, however, that the most effective surgical measure is partial thyroidectomy. While death takes place following the operation in a small proportion of the patients so treated, a large number of complete cures has been observed and improvement follows the procedure almost without exception. Supplementary operation becomes necessary in some instances. Complete thyroidectomy would seem inadvisable because of the possibility of producing myxœdema.

MYXŒDEMA.

Synonyms. Athyrea; Cachexia Thyroidea vel Strumipriva vel Thyreapriva.

Definition. A constitutional disease characterized by dryness of the skin, myxœdematous infiltration of the subcutaneous tissues and atrophy of the thyroid gland.

Ætiology. The specific cause of this affection is disease or removal of the

thyroid gland resulting in the deprivation of the body of the normal secretion of this organ.

Pathology. Autopsy discloses the presence of a mucous œdema of the subcutaneous connective tissues and absence or atrophy of the thyroid body. In cretins the pituitary body has been found enlarged and the cerebral convolutions may be indistinct. The lack of development of the nervous system may be associated with a similar condition of the blood-vessels of the brain.

Symptoms. Three types of the condition may be described.

1. *The Myxœdema of Adults* (Gull's Disease). This form of the affection is much more common in women than in men and is observed chiefly during young adult life and middle age. Several instances may occur in one family and heredity through the female line is sometimes a factor in its incidence. It seems to bear no relation to the genital system.

The onset may be characterized by the symptoms of exophthalmic goitre but with the appearance of the myxœdema, which involves the face especially, although the other parts of the body, including the tongue and at times the viscera may be affected, the countenance becomes swollen. This is the result of a firm infiltration of the subcutaneous tissues with a mucoid substance which causes a broadening and flattening of the face, together with a loss of expression. The lips and nose become thickened and the myxœdema of the skin of the neck produces folds which may even extend below the clavicle. The skin itself becomes dry and scaly and may assume a yellowish color and a waxy appearance; a reddish flush is sometimes present upon the cheeks and nose and the nutrition of the hair is imperfect. The hands and feet become misshapen, movement is slow and the mentality becomes sluggish. The memory is impaired and the disposition irritable and suspicious; hallucinations and even dementia may ultimately appear. There is no febrile movement, indeed the temperature is often subnormal and the patient is very susceptible to the influence of cold. There is no interference with the functions of the various organs although albuminuria and glycosuria may be observed. The thyroid gland is atrophied and may become converted into fibrous tissue.

The course of the affection is slow and is usually prolonged over a period of a number of years, death taking place, as a rule, from intercurrent disease.

2. *Cretinism.* The cretinoid condition is a result of absence or a loss of function of the thyroid gland and may evidence itself at birth or make its appearance during childhood. It is a type of idiocy characterized by an impairment of both physical and mental development. At birth cretinism may fail of recognition but by the time the child has reached the age of a few months it becomes evident that the growth, mental as well as bodily, is not normal; the face is large and of unintelligent expression, the size of the tongue is

increased and the organ protrudes, the skin is dry and the hair scanty; gradually these manifestations become more and more apparent and by the time the patient has become two or three years old the condition is quite unmistakable. In addition to the characteristics mentioned above, the lips become thickened, the eyelids puffy, the nose flat and the neck thick. The child's limbs are short and the abdomen is protuberant; the extremities are poorly developed, dentition and the closure of the fontanelles are delayed. The muscles are weak and as a consequence the child does not walk until late. Fatty pads are present above the clavicles and the arrest of mental development results in various types of idiocy. The cretin may live to adult life but remains dwarfed in body and mind.

Atrophy of the thyroid gland may occur in previously healthy children as a result of one of the acute infections and subsequent critinism has been observed.

The cretinoid state occurs in two forms, the sporadic, which is the type described above, and the endemic. The latter form is met in regions where goitre is also endemic, particularly certain parts of Switzerland, France and Italy. Its cause is unknown, the condition developing in previously normal subjects coincident with change in the thyroid gland.

Cretinism is easily recognized on account of its distinctive characteristics; the condition which most closely resembles it is *chondrodystrophia fœtalis* or *achondroplasia*. Here the limbs are short and curved and the articulations are enlarged as a result of hypertrophy of the cartilages of the extremities of the bones. The affected individual is dwarfed but there is no such lack of mental development as occurs in cretinism.

3. *Cachexia strumipriva* or *operative myxœdema* is the term applied to myxœdema resulting from removal of the thyroid gland. It is more common after total thyroidectomy than when only a part of the gland has been excised, but does not result in every instance of entire removal of the organ, possibly because portions of the gland have been inadvertently allowed to remain or an accessory thyroid may have been present.

The diagnosis of myxœdema, on account of the very characteristic appearance of the patient, is simple. The œdema of nephritis and of endocarditis pits on pressure and is associated with the presence of albumin and casts in the urine (which may, however, be observed in myxœdema), cardiac symptoms and physical signs; there is no lack of mental and bodily development in these latter affections.

The prognosis under proper treatment is good, the results obtainable being little less than marvelous.

Treatment. It is in the treatment of myxœdematous conditions that organotherapy is most successfully exemplified. The thyroid gland of the sheep is chiefly used either in its raw form, as the glycerin extract, or in tablets

made from the cleaned, dried and powdered gland; the gland itself is inferior to either of the other preparations, particularly on account of its inconvenience. The usual dose of the glycerin extract is from 15 to 30 minims (1.0 to 2.0) daily; that of the dried and powdered gland about 4 grains (0.25) three times a day; iodothyrin in dose of 3 grains (0.20) may be employed. Unless improvement is noted within a short time the dosage should be increased until there is distinct amelioration of the symptoms. In instances which react well the body weight diminishes, the skin becomes moist, the pulse becomes more rapid and there is distinct improvement in the mental state. At the beginning of treatment the patient should be carefully observed lest heart failure, of which a few instances, following excessive dosage, have been reported. As a rule no ill effects are observed but sometimes over-doses produce symptoms analogous to those of exophthalmic goitre, cutaneous irritation, restlessness, rapid heart action and mental excitation. These disappear upon the diminution of the quantity of the gland administered. Arsenic when given in connection with the preparations of the thyroid gland is said to lessen the possibility of toxic effects.

As the symptoms disappear the dosage should be diminished and when cure becomes evident our object should be merely to prevent a recurrence. Since the thyroid gland of the patient is absent or functionless, it follows that when the treatment is stopped we are practically certain to be confronted with a reappearance of the symptoms of the disease. Such a circumstance may be prevented by the administration of a daily small dose of the thyroid extract or powdered substance. The amount necessary must be determined independently for each patient but in general it may be said that it should be sufficiently large to prevent the occurrence of such symptoms as an abnormal temperature and subcutaneous infiltration. It is usually necessary to continue this second stage of the treatment indefinitely.

Myxœdematous patients suffer more in cold weather than in warm, consequently when practicable, they should seek the warmer climates and when this is not possible all means should be employed to prevent chilling of the body. Warm baths and frequent massage of the scalp will to some extent relieve the tendency to dryness of the skin and improve the nutrition of the hair.

Cretinism should be treated in the same way as myxœdema and with the same precautions; cretinoid children, however, may take relatively larger doses of the thyroid preparations than myxœdematous adults. The results of treatment are often astounding and comprise a diminution of the deformity, an increased growth and a disappearance of the idiotism. The treatment is most effective when begun early. Iodothyrin is said to be less apt to cause unpleasant manifestations than the glandular substance or extract, and to be quite as productive of good results.

Cachexia strumipriva necessitates the thyroid treatment just as do the other types of myxœdema and its continuance for the remainder of the patient's life is usually essential; periods of intermission, however, are often advisable, the reappearance of symptoms being the signal for the resumption of the thyroid preparation chosen.

The glycerin extract of the thyroid gland may be made by separating the connective tissue from the substance of several dozen thyroids of calves or young sheep; these are divided into small pieces and covered with pure glycerin, about 30 minims (2.0) of the latter substance being allowed for each lobe used. The mixture is allowed to stand for thirty hours and is then pressed through a cloth, so as to obtain as much liquid as possible. Of this about 30 minims (2.0) constitute a dose. The fluid may be given hypodermatically by adding to it 1 percent. aqueous solution of phenol (carbolic acid) in the proportion of 60 minims (4.0) to 30 minims (2.0), the dose of the mixture being from 10 to 15 minims (0.66 to 1.0) three or four times weekly.

The gland substance itself may be given raw or slightly cooked. When prescribed thus it may be finely divided and spread on bread, the daily quantity being from one-fourth to one-half a gland daily.

Thyroid grafting has been employed in cretinism and myxœdema, the fresh gland of the sheep being implanted in the peritonæal cavity of the patient. Previous to the operation, thyroid extract should be given until the symptoms of the disease have been at least partially relieved. By means of this procedure a temporary disappearance of the affection has been effected; ultimately, however, the symptoms have usually reappeared and a second operation or the administration of thyroid preparations has become necessary.

NEOPLASMS OF THE THYROID GLAND.

Various new growths may involve the thyroid gland; of these the most common are:

1. *Adenoma.* This type of tumor is usually encapsulated and may be either single or multiple. The malignant adenomata may be associated with metastases in different parts of the body.

2. *Sarcoma* of the thyroid may occur.

3. *Tuberculoma* of the gland has been noted in association with tuberculosis of other structures, but is rare.

4. *Gummatous tumors* of syphilitic origin.

5. *Hydatid cysts.*

All these are of little medical interest and their treatment, with the exception of the tuberculous and syphilitic growths, is surgical.

Accessory and aberrant thyroid glands; these are not of very unusual occur-

rence. They may be found anywhere between the base of the tongue and the aortic arch. Tumors of thyroid tissue of considerable size have been found in the mediastinum and pleura. *The lingual thyroid* may grow to the size of a pea and is usually situated in the substance of the lingual muscles or is attached to the hyoid bone. A goitrous condition, characterized by moderate enlargement of this structure, has been observed and, in the absence of the normal thyroid, its excision has resulted in myxœdema.

DISEASES OF THE THYMUS GLAND.

The functions of this structure are not definitely known. The organ increases in size up to the end of the second year, weighing at this time in the neighborhood of one ounce (30.0); from the age of two years, it gradually shrinks, until at puberty it has become a mere bit of fatty tissue.

The thymus gland is subject to various pathological changes.

Hypertrophy of the gland is sometimes observed and one of the chief points of interest in this condition is its influence in the production of thymic asthma which is a result of pressure. Laryngismus stridulus has also been attributed to enlargement of the gland; certain clinicians, however, believe that the latter is a convulsive affection and in no way due to thymic hypertrophy.

Thymus Death. Instances of sudden death in children have been observed which are associated with hypertrophy of the gland and sometimes with a hyperplastic condition of the entire lymphatic system (see the section upon Status Lymphaticus). Where the thymus only has been found enlarged, death has been thought to be due to pressure upon the trachea or upon the pneumogastric nerve. Epilepsy is sometimes accompanied by a persistently enlarged thymus gland and hyperplasia of the other lymphatic tissues.

Enlargement of the gland has been found in exophthalmic goitre.

Atrophy of the thymus gland is occasionally observed both in primary and secondary types. The former is believed to have some association with marasmatic conditions and the latter is found in chronic wasting diseases such as tuberculosis.

Hæmorrhages into the thymus gland occur in the various hæmorrhagic diseases and have been noted in children after death from asphyxia.

Abscess of the gland has been found and is said to be chiefly associated with instances of congenital syphilis.

Neoplasms, such as sarcomata, gummata and dermoid cysts, are not very uncommon and mediastinal tumors not infrequently develop from the remnant of the gland.

Tuberculous inflammation, characterized by the production of miliary tubercles, has been described.

DISEASES OF THE SUPRARENAL CAPSULES.

ADDISON'S DISEASE.

Definition. A chronic affection probably the result of non-function of the suprarenal bodies and characterized by progressive weakness, pigmentation of the skin and digestive irritability.

Ætiology. The disease is more frequent in men than in women and it usually appears during young adult life or in early middle age. One congenital instance has been reported. The onset of symptoms may be subsequent to traumatism of the abdomen or back or to spinal caries.

Pathology. The most common *post mortem* lesion is tuberculosis of the suprarenal capsules with fibro-caseous and calcareous degeneration. Other conditions which have been observed are cystic and fatty degeneration, atrophy, simple or preceded by a chronic interstitial inflammation, carcinoma, sarcoma, hæmorrhage and embolism. In some instances the suprarenal bodies have been found normal and here the symptoms have been accounted for by inflammation of or pressure upon the sympathetic ganglia. Degeneration and pigmentation of the semilunar ganglia and sclerosis of the nerves have been noted. Cicatricial tissue about the suprarenals may surround the ganglia. An enlargement of the spleen and of the thymus gland may exist as associated lesions.

The two chief theories of the pathogenesis of Addison's disease are (1) that it is due to non-function of the adrenals just as myxœdema is the result of a similar condition of the thyroid gland; (2) that it follows interference with the proper working of the abdominal sympathetic system usually caused by disease of the suprarenals and by other affections of the solar plexus.

Symptoms. The onset of the disease is usually slow, with gradually increasing asthenia followed by cutaneous pigmentation. An acute type of the affection has been described in which a rapid evolution of the symptoms has taken place after severe shock or depression.

The discoloration of the skin is, as a rule, the first symptom noticed; this varies from light yellow to dark brown or even black. It is most apparent upon the exposed parts such as the face and hands, in other situations where pigment is normally most abundant such as the scrotum, and where the skin is irritated by the clothing. Rarely the pigmentation may be general and at times it is wholly absent. It is often found upon the mucous membranes of the mouth, conjunctiva and vagina. At times there are patches of leucoderma, the normal pigment being entirely absent. Very infrequently there may be deposits of pigment in the serous membranes and upon the discolored skin there may be small spots of deeper pigmentation.

The digestive symptoms consist of nausea and vomiting, particularly

marked at the inception of the disease; diarrhœa may be present from time to time and anorexia is not infrequent. In the late stages abdominal pain with retraction may appear.

Progressive weakness is a constant and characteristic symptom and may become so extreme that the patient is unable to leave his bed. With the muscular weakness there is accompanying cardiac asthenia with feeble heart action, small and rapid pulse, dyspnœa, dizziness and even fatal syncope. Headache and pain in the back are common. Convulsions may occur.

The condition of the blood is usually normal; the same is true of the urine but increase in the contained pigment has been observed. Polyuria may occur.

The diagnosis should not be made upon the presence of cutaneous pigmentation alone for there are many conditions of which this is an accompaniment. Of these may be mentioned peritonæal tuberculosis, abdominal malignant growths, melanotic cancer, pregnancy, hepatic disease, bronzed diabetes, vagabondism with marked filthiness, the prolonged administration of arsenic, exophthalmic goitre and cardiac and arterial disease. All these should be excluded before Addison's disease is diagnosticated and even then associated symptoms—weakness and gastro-intestinal disorders—should be sought before arriving at a definite conclusion. The employment of the tuberculin test may clear up doubtful instances if due to tuberculosis of the adrenals.

The prognosis is unfavorable although treatment may prolong life and make the patient comfortable. Marked pigmentation augurs a protracted course and patients in whom this manifestation is slight or absent usually fail rapidly. There are patients in whom the evolution of the affection is acute, the symptoms are marked, and in whom death takes place within a few weeks. The average duration of the disease is from two to three years. Death occurs as a result of the increasing weakness, in syncope or from associated tuberculous lesions.

Treatment. The management of this disease should be so carried out as to conserve the patient's strength as much as possible and to sustain the proper functions of the various organs. The patient should live a quiet life and all physical and mental excitation should be avoided on account of the danger of syncope. In the later stages it is best to confine the patient to bed. The diet should be plentiful, nourishing and easily digestible; during the periods of gastric and intestinal disturbance, a strictly fluid regimen, consisting of milk, broths, etc., should be enjoined. Iron may be given as a tonic but, as anæmia is seldom a prominent feature of the disease, is usually less efficient than strychnine, arsenic, codliver oil, phosphorus and the bitters. Acute vomiting and diarrhœa necessitate a diet of fluids such as milk, koumyss, matzoon, peptonized milk, albumin water, etc., and the administration

of anti-emetic drugs such as cerium oxalate, of which 10 grains (0.66) may be combined with 20 grains (1.33) of sodium bicarbonate and added to each glass of milk; in this connection cracked ice, iced champagne, dilute hydrocyanic acid, creosote and tincture of iodine are useful. The diarrhœa may be controlled by the ordinary means, such intestinal disinfectants as phenyl salicylate and bismuth naphtholate being especially useful; other bismuth salts are also effective. The muscular weakness may be combated by the use of electricity, massage and hydrotherapeutic measures.

The extraordinary results achieved in myxœdema by the administration of the thyroid gland would give ground for hope that in the analogous condition present in Addison's disease equally good results might follow the use of the suprarenal extract. Unfortunately treatment by this means as yet has proven of little benefit but it is quite possible that the results of future experimentation may be more favorable than those achieved up to the present time. Instances have been cited in which the administration of a glycerin extract, made from the suprarenals of the pig just as the thyroid extract (see p. 543) is made, given in doses of about 4 ounces (120.0) three times daily, was followed by marked improvement; the pigmentation, however, persisted. The suprarenal gland may be taken raw or slightly cooked or the gland substance may be prescribed in the form of tablets of the dried extract. The dose of desiccated suprarenal glands is 4 grains (0.25). The usual daily dosage of the suprarenal preparations is about the equivalent of two glands. While no curative effect should be promised from this treatment, a trial of it should never be omitted as no evil sequelæ result and much benefit may follow.

CHAPTER VII.

DISEASES OF THE HEART AND BLOOD-VESSELS.

DISEASES OF THE PERICARDIUM.

ACUTE PERICARDITIS.

Definition. An acute inflammation of the serous membrane surrounding the heart.

Ætiology. This affection may occur primarily as a result of tuberculous infection, as a result of traumatism either external or internal, from the migration of a foreign body from the œsophagus, or perhaps as a result of rheumatic infection which manifests itself in the pericardium instead of in the articulations. Idiopathic instances may be observed.

Secondary pericardial inflammations are far more common than primary. They may occur as a complication of acute rheumatism, accompanying joint inflammation or tonsillitis; as a complication of the acute infectious diseases, particularly scarlatina and acute infectious pneumonia; in septicæmia and pyæmia; in tuberculosis; with chorea; and in the later stages of various chronic dyscrasiæ such as gout, nephritis, diabetes and the hæmorrhagic diseases.

Pericarditis also occurs as an extension of affections of neighboring organs or tissues, e.g., in chronic endocarditis, pleurisy, pneumonia, aneurysm, etc. Inflammatory processes and neoplasms in the ribs, œsophagus, vertebræ, mediastinal glands and even of structures beneath the diaphragm may cause pericarditis by extension.

The disease in the majority of instances is rheumatic in origin; it is common to all ages but seems to attack males more frequently than females.

Pathology. The disease may be considered to occur in three stages. First, the membrane is congested and reddened, it becomes roughened and an exudation of fibrin involving more or less of its surface, takes place, the latter assuming a ridged or fringe-like appearance. The heart muscle may be involved in the inflammation to a slight degree, if the pericardium is markedly affected, as is shown by an anæmic appearance. In tuberculous instances the miliary tubercles may be detected by close scrutiny. In simple fibrinous pericarditis the exudation softens and is absorbed, leaving behind a normal or adherent pericardium, but more often the affection passes on to the serous stage. Here there is added to the plastic exudate an effusion of serum, which

distends the pericardial sac to a greater or less extent. This fluid is amber-colored and clear, although in it there may occur floating particles of fibrin. This effusion may be absorbed, the pericardial surfaces being left adherent in many instances, or it may become purulent. The adhesions may render the two layers of the pericardial sac almost like a single thickened membrane or, villous adhesions resulting, the two pericardial layers are permitted to move one upon the other with the impulse of the heart. These villous adhesions are composed of vascular connective tissue which is produced by a proliferation of the normal connective tissue of the membrane and resemble the papillæ of a sheep's tongue or buttered surfaces of bread which have been separated.

Suppuration may be primary or secondary, the effusion being purulent from the first, or, in the latter instance, pyogenic infection of the serous fluid may take place later. In tuberculous pericarditis the exudate may undergo caseous degeneration.

The pathogenic bacteria most usually found in acute pericardial inflammations are the ordinary germs of suppuration, the tubercle bacillus and the pneumococcus.

Symptoms. These differ with the pathological condition; while pericarditis may begin with a chill or pain referred to the heart, the fibrinous type often exists without subjective symptoms. The pain may be merely a sense of cardiac discomfort or it may be referred to the ensiform cartilage or to the epigastrium. The temperature usually is dependent upon the primary affection; in primary pericarditis it seldom exceeds 102° F. (38.9° C.). The pulse is increased in rapidity and dyspnœa may be present. Precordial tenderness may be observed.

Pericardial effusions by pressure interfere with the heart's action causing a rapid and perhaps irregular pulse. With inspiration the pulse beat may become much weakened or even imperceptible (*pulsus paradoxus*). Interference with cardiac action also results in dyspnœa, with cyanosis, and the patient may prefer to lie upon the left side or may be unable to breathe comfortably unless he sits up. Large collections of fluid encroach upon the left lung, press upon the œsophagus causing dysphagia, or upon the left recurrent laryngeal nerve causing aphonia. The patient is restless and sleepless, and cerebral symptoms, even delirium and coma, may be present, especially in the rheumatic instances with high temperature. In suppurative pericarditis the constitutional symptoms are usually more marked and the fever is of septic type. The invasion of the pyogenic micro-organisms may be evidenced by a chill.

Physical Signs. a. Of fibrinous pericarditis. Pressure over the precordium or over the ensiform may elicit tenderness and upon *palpation* a rough fremitus corresponding to the pericardial friction sound may be

detected. *Auscultation* reveals the presence of the pericardial friction sound; this is heard with greatest intensity over the left half of the sternum at the level of the fourth and fifth intercostal spaces and in these spaces close to the sternum, i.e., where the heart most closely approximates the chest wall; it is usually a to-and-fro murmur but may be single or even triple. In quality it is rasping, grating, or, more rarely, creaking; the sound is close to the ear and may be increased in intensity by the pressure of the stethoscope. It is not constant and may at intervals be inaudible or change in its quality or intensity from time to time or with the position of the patient. Its transmission varies; it may be localized to a small area or transmitted in various directions; there is no fixed rule.

b. Of pericarditis with the effusion of fluid. Here the physical signs vary with the quantity of the fluid. If this is large, and especially in children, there may be a fulness or bulging of the precordium and the apical impulse is wavy or perhaps absent; the upper border of the first rib may be unduly prominent (Ewart's sign); pressure upon the left lung may diminish its expansion and downward pressure may displace the left lobe of the liver and cause an epigastric prominence. (Auenbrugger's sign). *Palpation* reveals a diminished or absent impulse and, as the effusion increases, the friction thrill diminishes; it may be palpablate the base only and then only when the patient is sitting. In the recumbent position it is likely to be absent. Upon *percussion* an increased area of dulness is made out, this is irregularly triangular, the base being directed downward and the apex upward. Rotch's sign, an absence of resonance in the fifth right space, may be present and there may be an area of dulness or flatness posteriorly below the angle of the left scapula. *Auscultation.* The friction sound may disappear on account of the separation of the layers of the pericardium by the effusion or it may remain audible at the base. The heart sounds are indistinct and muffled or even almost inaudible. The pulse rate is increased and the heart action may become arrhythmic. A systolic murmur at the base and an accentuation of the second pulmonic sound may be present. There may be an area of broncho-vesicular or bronchial breathing posteriorly below the angle of the left scapula or between this point and the vertebral column.

As the fluid gradually is absorbed the physical signs return to normal, either with or without the reappearance of the friction murmur, or, if permanent pericardial adhesions are formed, the physical signs of this condition may be apparent.

The diagnosis of pericarditis is often overlooked, consequently in all instances of acute articular rheumatism daily examination of the heart should be made. In patients in whom the typical to-and-fro murmur, heard close under the ear, is present the diagnosis is simple, but unfortunately the characteristic physical signs are often absent; here the direction of transmission of the murmur is

of aid, there being no rule for the transmission of a pericardial murmur, as also is the fact that the sound becomes louder upon pressure with the stethoscope. The so-called "pleuro-pericardial" friction sound may be distinguished from the pericardial murmur by the facts that it is more usually heard over the left border of the heart and is louder during expiration, often being absent during inspiration; also it may cease upon holding the breath, but not always since it is due to the motion of the heart. The differentiation of pericarditis with effusion from acute cardiac dilatation: in the latter, if the patient is thin, the apical impulse is diffuse and undulatory, while it is usually indefinite or even absent in pericarditis. In dilatation the apex beat is more distinctly palpable; percussion reveals the typical triangular area of dulness in pericarditis, the upper limit of which may change with the position of the patient; in dilatation the dull area is not triangular nor does it extend so high or so low. On auscultation the heart sounds in pericarditis are muffled and indistinct while in dilatation they are much less so and may be sharp and definite. Dulness and changes in the breath sounds below the angle of the left scapula and tympany in the axilla, due to pressure upon the lung by the effusion, are absent in dilatation. Large pericardial effusions have been mistaken for localized pleural exudates. The character of the fluid cannot be certainly determined without paracentesis, but it is usually serous in rheumatic, while in pyæmic and tuberculous instances it is likely to be purulent; bloody fluid may occur in tuberculous pericarditis or that seen as a terminal inflammation of nephritis, etc.

The prognosis is variable, the sero-fibrinous rheumatic instances usually going on to recovery in two or three weeks; relapses may, however, occur, or the condition pass on to a chronic adhesive pericarditis. Recovery from septic and tuberculous pericarditis is rare.

Treatment. The patient should be at once put to bed and kept at rest. If he is more comfortable in this position his back may be supported by pillows or a rest. The over-action of the heart should be relieved by the application of an ice coil or bag to the precordium. In the rheumatic instances sodium salicylate in doses of 1 to 1½ drachms (4.0 to 6.0), or aspirin 45 grains (3.0) daily, may be given internally. Usually, however, the inunction of an ointment containing 1 part each of salicylic acid, oil of turpentine and lanolin to 5 parts of simple ointment is to be preferred; of this a drachm (4.0) should be thoroughly rubbed into the precordium three times a day. The excitability of the heart is best relieved as above stated by the application of cold in connection with the administration of glyceryl nitrate in considerable doses—gr. $\frac{1}{50}$ (0.0012)—three or four times a day in order to render the heart's work more easy by lessening the peripheral resistance. Venesection may be employed in plethoric individuals with the same object in view. These means are preferable to the administration of digitalis and

aconite. If pain is very severe we may give morphine hypodermatically with atropine—$\frac{1}{3}$ of a grain (0.022) of the former to $\frac{1}{100}$ of a grain (0.0006) of the latter; these drugs, however, should not be employed unless absolutely necessary.

Upon the incidence of the effusion the above treatment should be continued and a good sized blister may be applied to the precordium; not only does this act as a counter-irritant to the pain but in some patients it has a certain effect in causing absorption of the fluid. If the heart becomes weak and there is venous stasis, strychnine and digitalis are indicated, or if there is tendency to syncope and collapse, this is to be combated by the hypodermatic injection of caffeine sodio-benzoate 2 to 5 grains (0.13 to 0.33) or of camphor dissolved in sterile olive oil or æther. Dyspnœa due to congestion of the lungs may be relieved by strychnine, which may be given, if necessary, in doses as large as $\frac{1}{10}$ of a grain (0.006). Acute cardiac dilatation with cyanosis may be treated in the same fashion. Throughout the course of the affection the bowels should be kept freely open and the activity of the kidneys, which may aid in causing the disappearance of the effusion, should be insured by the administration of alkaline diuretics and of the infusion of digitalis when indicated.

When the quantity of the effusion is so large as to interfere with the heart's action as evidenced by marked dyspnœa and cyanosis, weakness of the pulse, an expression of anxiety, and coldness of the extremities, the pericardium should be tapped and the pressure relieved. An effusion large enough to displace the diaphragm and the underlying viscera may also be diminished to advantage by paracentesis. Drawing off the fluid usually results in quick relief of the pressure symptoms but may not be followed by quick recovery. Several tappings may be necessary, especially if the inflammation is tuberculous. In moderately large effusions the point of puncture may be in the fourth intercostal space about an inch (2.5 c m.) to the left of the sternal margin or in the fifth space $1\frac{1}{2}$ inches from this edge. Dieulafoy advises puncture in the fourth or fifth space 2 to $2\frac{1}{2}$ inches from the sternum. Others advise the insertion of the needle outside the nipple line. In very large effusions a safe point is in the left xipho-costal angle, the needle being directed upward and backward. It is unwise to draw off all the fluid at once, 6 to 16 ounces (180.0 to 500.0) being sufficient for one time; repetition may be necessary after a few days. If the fluid is purulent simple tapping is insufficient; incision and drainage are necessary. It is probable that recovery in pyo-pericarditis would be much more frequent under early surgical treatment. It should be needless to state that pericardial puncture should be performed under the strictest asepsis.

The diet during the acuity of the course of a pericarditis should be of nourishing fluids.

CHRONIC ADHESIVE PERICARDITIS.

This condition often occurs in young persons as a result of a plastic pericarditis. Two forms are described: *a*. Simple adhesion of the peri- and epicardial layers; this often causes no symptoms and its existence is unsuspected until revealed upon the autopsy table. *b*. Adherent pericardium with chronic inflammation of the mediastinum and union of the parietal layer of the pericardium to the pleura and thoracic wall. This type is especially serious in children and may go on to extreme cardiac hypertrophy and dilatation.

Symptoms. In type *a* the symptoms as stated are unnoticeable; in type *b* they are those of cardiac hypertrophy and dilatation with subsequent insufficiency. With the pericardial adhesions there may proliferative pleuritis, peritonitis, perihepatitis and perisplenitis, in a word a panserositis, with which there may be chronic ascites.

Physical Signs. Upon *inspection* a bulging of the precordium may be noted. Friedreich's sign, a diastolic collapse of the cervical veins due to their sudden emptying resulting from the expansion of the thorax, may be present. Broadbent's sign, a systolic tug communicated through the adherent diaphragm, may be noted; this is best observed between the eleventh and twelfth ribs behind on the left side. *Palpation* reveals a diffuse apical impulse extending in marked instances from the third to the sixth space in a vertical direction and laterally from the right parasternal line to without the left nipple. The apex beat may be variously displaced, is wavy in character and with the systole there may be a retraction of the thoracic wall; the hand may detect a quick rebound of the wall of the chest, the diastolic shock; these two latter are the most typical signs of adherent pericardium.

The *pulsus paradoxus* may be present but is not pathognomonic. Upon *percussion* the cardiac dulness is much increased. Adhesions of the pericardium to the pleura prevent the lessening of the cardiac dulness upon deep inspiration. The signs elicited by *auscultation* are neither constant nor characteristic. Murmurs due to co-existent endocardial lesions are often present and there may be a modified pericardial friction sound resembling the sound caused by bending a piece of new leather. A ventriculo-systolic murmur due to a relative mitral insufficiency or an auriculo-systolic murmur may be heard. The course of chronic adhesive pericarditis is prone to be protracted, the lesion being very likely to be permanent.

Treatment consists in improving the patient's general condition by the administration of tonics and nourishing food. The symptoms should be combated by appropriate measures and it may be possible to facilitate the absorption of the connective tissue adhesions by the persistent inunction over the cardiac region of a 6 percent. ointment of iodine vasogen and the

internal administration of the syrup of hydriodic acid in doses of 1 drachm (4.0) in a wineglass (60.0) of water one-half an hour before each meal.

OTHER PERICARDIAL AFFECTIONS.

Hydro-pericardium, an increase of the normal amount of serous fluid contained in the pericardium, occurs in cardiac or nephritic conditions associated with a general anasarca. The amount is not often large and the presence of the fluid may be overlooked. Large transudates cause interference with the action of the heart. The physical signs are identical with those of pericarditis with effusion.

Hæmo-pericardium. Blood is found in the pericardial sac as a result of rupture of aneurysm of the aorta, of the coronary arteries, of the heart itself or of wounds. Blood-tinged fluid may be found in the pericardium in tuberculosis or malignant growths of the membrane as well as in the pericarditis occurring with nephritis. The physical signs are those of any pericardial effusion.

Pneumo-pericardium is rarely seen and is a condition in which the pericardial sac contains gas and fluid, usually purulent in character. It is most often the result of traumatic or other perforation, from new growth, for instance. In the non-perforative instances the growth of the *bacillus ærogenes* may be responsible. The symptoms consist of precordial pain and embarrassment of the heart's action. The physical signs are typical. The precordium may be bulging and the apex beat obscured. The note below is dull due to the presence of fluid, above it is tympanitic. The extent of these areas may differ upon change of the patient's position. Auscultation reveals a heart sound of metallic, splashing or gurgling quality. The friction sound if present, is also of metallic quality.

Calcification of the pericardium is rare but may occur subsequent to pericardial inflammations, especially those of purulent or tuberculous type. It sometimes occurs in panserositis.

Treatment of the above conditions is of little avail. If excessive fluid causes cardiac embarrassment this may be relieved by tapping and surgical measures may be useful if external wound is present.

DISEASES OF THE MYOCARDIUM.

CARDIAC HYPERTROPHY.

Definition. An enlargement of the heart characterized by increase in the thickness of the walls of the organ and with or without increase in the size of its cavities. When the size of the cavities is not augmented the condition is

termed *simple hypertrophy;* if the enlargement affects both the thickness of the walls and the size of the cavities it is spoken of as *eccentric hypertrophy.* The enlargement may involve the entire heart, one side alone or only one cavity.

Ætiology. The condition is an increased growth of muscular tissue and is the result of a physiological effort to perform increased work. The left ventricle becomes the seat of hypertrophy when there are such interferences to its action as are furnished by obstruction or insufficiency of the aortic valve, by insufficiency of the mitral valve, adhesions of the pericardium, interstitial myocarditis, disorders of the innervation of the organ followed by increased cardiac action such as occur in chronic palpitation, exophthalmic goitre, etc., and in disturbances of the vascular system such as arteriosclerosis, aneurysm, contraction of the peripheral blood-vessels induced by the presence of toxic substances in the blood as in nephritis; hypertrophy also occurs in muscular over-exertion (the athlete's heart) and in congenital narrowing of the aorta.

Hypertrophy of the right ventricle is brought about by any condition which increases the resistance to the pulmonary circulation such as disease of the mitral valve; pulmonary emphysema or fibrosis; lesions of the valves of the right side of the heart, which are often congenital; valvular lesions of the left heart in the later stages result in pulmonary stasis and consequent obstruction to the pulmonary circulation causing hypertrophy of the right ventricle, and adhesions of the pericardium may cause mechanical interference with its free action and consequent hypertrophy.

Hypertrophy of the auricles is always associated with dilatation of these cavities. The left auricle is hypertrophied as a result of mitral obstruction and to a less extent hypertrophy is caused by the regurgitation of the blood in mitral insufficiency. Hypertrophy of the right auricle is less likely to result from tricuspid disease since here there is much less resistance to the further backward flow into the veins than upon the left side of the heart.

Pathology. The hypertrophied heart is heavier and larger than the normal organ and its shape is changed. With hypertrophy of the left ventricle its shape is less conical than normal, its position is more horizontal and it is elongated to the left. Hypertrophy of both ventricles results in a more rounded shape and when the hypertrophy chiefly involves the right side, the most bulky part of the organ is the right ventricle. The walls of the hypertrophied ventricles are much thickened and the muscle fibres are darker in color and more dense than normal.

Symptoms. Hypertrophy is primarily a condition of physiologic compensation and at first is unattended by symptoms, but as a result of its continuance pathological changes take place and connective tissue over-growth occurs producing sclerosis of the arteries of the heart muscle and fibrous degeneration of the walls of the organ and the valves. These abnormalities are evidenced

by symptoms which at their inception are not constantly present but are induced by over-exertion, mental or physical, over-indulgence in stimulants, tobacco, etc. The patient now complains of cardiac discomfort, increased by lying upon the left side, consciousness of the heart's action, palpitation, vertigo, tinnitus, visual disorders, flushing of the face and epistaxis.

Physical Signs. Inspection may reveal a bulging of the precordium, especially in children, a displacement of the apex beat downward and toward the left and a forcible and diffuse apical impulse; there may be visible pulsation of the carotids. *Palpation* confirms the displacement and over-action at the apex; the radial pulse is regular, full and tense. *Percussion* in hypertrophy of the left ventricle shows enlargement of the area of cardiac dulness to the left and downward; of the right ventricle increased dulness to the right margin of the sternum and beyond. *Auscultation* reveals an apical first sound prolonged, dull and perhaps reduplicated; the second aortic sound is accentuated and it may be reduplicated in left ventricular hypertrophy, while in right ventricular hypertrophy the second pulmonic sound is increased. A tinkle may be audible at the right of the apex (Boutillau's sign). The apex, in hypertrophy of the right ventricle, is displaced to the left but not downward and if there is no accompanying left ventricular hypertrophy the radial pulse is small.

The cardiac shadow, in left ventricular hypertrophy, as shown by the Röntgen ray, is enlarged, principally downward and to the left; in hypertrophy of the right ventricle chiefly to the left and but little downward; in extreme instances the cardiac shadow may be seen to the right of the sternum.

The diagnosis from neurotic palpitation is made upon the heaving character of the apex beat, the increase in cardiac dulness and the presence of accentuation of the second sounds. Retraction of the lung may uncover the heart so that its area of dulness is much increased and hypertrophy may be obscured by the interposition of an emphysematous lung. In pericardial effusion the area of dulness is of characteristic triangular shape, the heart sounds are obscured and the pulse is feeble. In hypertrophy with dilatation the pulse is less strong and regular, murmurs are frequently present and there is less likely to be accentuation of the second sounds at the base.

The prognosis in cardiac hypertrophy due to toxæmia is favorable until permanent arterial changes take place. When it is the result of arteriosclerosis or aneurysm the prognosis is that of these conditions. Hypertrophy with chronic valvular disease is a conservative physiological process and lasts until for some reason, over-exertion, intercurrent illness, malnutrition etc., dilatation supervenes.

Treatment. So long as no symptoms are present this consists in maintaining the patient's nutrition, avoiding over-exertion and indulgence in alcohol, tobacco, tea and coffee and in obtaining sufficient sleep. Simple tonics may be prescribed if indicated. If arteriosclerosis is present we may

administer the iodides, preferably in the form of the syrup of hydriodic acid, 1 drachm (4.0) in a wineglass (60.0) of water a half hour before each meal. For the cardiac distress the fluidextract of cactus in doses of 10 to 20 minims (0.66 to 1.33) three times daily may be given. If the palpitation is annoying the following prescription may be found beneficial: ℞ potassii bromidi, potassii iodidi, āā gr. lxxv (5.0); syrupi aurantii ℥ vi (180.0). Misce et signa, two teaspoonsful (8.0) night and morning. If the heart is laboring against excessive arterial tension we may give glyceryl nitrate gr. $\frac{1}{100}$ to $\frac{1}{50}$ (0.0006 to 0.0012) or erythrol tetranitrate gr. $\frac{1}{4}$ to $\frac{1}{2}$ (0.016 to 0.032) made up in pill form with kaolin, three times a day.

CARDIAC DILATATION.

Ætiology. Acute cardiac dilatation of transitory type may occur as a result of pronounced muscular over-exertion. Chronic dilatation is associated with hypertrophy and is due either to an increase of the endocardial pressure resulting in over-filling of the chambers or to an obstruction to the outflow of blood caused by valvular or vascular lesions. These causes may not at once lead to dilatation but often first result in hypertrophy, the latter being always to some extent present except in instances of very acute dilatation. In eccentric hypertrophy dilatation is a process of physiological compensation, going on until failure of the nutrition of the heart supervenes when immediately the dilatation exceeds the hypertrophy to a marked extent (failure of compensation). This condition may result in endocarditis, the infectious diseases, chronic wasting diseases, and prolonged mental or physical over-exertion. Acute dilatation may result from sudden excessive muscular effort as in mountain climbing, rowing, bicycling, etc. Exercise within proper limits produces hypertrophy with dilatation, not simple dilatation, i.e., enlargement of the cavity with compensatory thickening of its walls. The harmful effect of prolonged cardiac strain is held in check temporarily by the action of the tricuspid valve in allowing a regurgitation of blood into the right auricle, but physiological dilatation has passed beyond its limit when the cavity has become unable to empty itself of blood. Here, although the reserve capacity of the heart has been exceeded, the normal condition may be restored by rest.

A second factor which may result in cardiac dilatation is a decreased resistance of the cardiac walls; these may be weakened by fatty and fibrous degeneration, the degeneration which takes place during the acute infectious diseases, in endocarditis and pericarditis, in disturbances of nutrition and in chronic blood diseases. Idiopathic dilatation may occur.

Pathology. Dilatation involves the right heart more often than the left and at least two chambers are usually affected; it is generally secondary to valvular defects and is, in most instances, associated with hypertrophy. Ex-

treme dilatation produces a relative insufficiency of the valves, these, although being of normal size and condition, are not able to close their respective orifices on account of the great expansion of the valvular ring consequent upon the dilatation or from the fact that the enlargement of the cardiac chambers so draws upon the papillary muscles that these are insufficiently long to allow the valve flaps to fall into place. The shape of the organ is changed depending upon the situation and extent of the dilatation; when this involves the whole heart its shape becomes somewhat spherical. The endocardium may be opaque and roughened; the myocardium is usually the seat of a fatty, fibrous or parenchymatous degeneration; degeneration of the cardiac ganglia has been observed.

Symptoms. *Sudden acute dilatation* is evidenced by cardiac or epigastric distress or pain, sudden dyspnœa, rapid and feeble heart action and signs of venous obstruction. In very acute instances sudden death without symptoms may take place. In the milder forms of the affection the patient suffers from palpitation, dyspnœa, faintness and feeble cardiac action; all these are much relieved by rest, but return upon the least exertion.

In *dilatation with compensatory hypertrophy* there are no subjective symptoms but immediately upon the disturbance of the compensation the signs of venous congestion are developed, dyspnœa, œdema, beginning in the feet and extending upward, rapid, feeble and irregular heart action, cough, digestive disturbances, dizziness and headache and even delirium and coma; rarely is the pulse rate slow. Palpitation and symptoms resembling those of angina pectoris may occur. The urine is dark, of high specific gravity, scanty and may contain hyaline casts and red blood cells.

Physical Signs. Upon *inspection* the apical impulse is seen to be weak, irregular and diffused over a considerable area, there may be no point of maximum intensity or this may be above and to the left of the normal position. When the hypertrophy chiefly affects the right side of the heart the apex impulse is absent but an impulse may be palpable below or to the right of the xiphoid cartilage and there may be a diffuse wave in the fourth, fifth and sixth left spaces. There may be a visible pulsation, usually synchronous with the systole, less frequently presystolic, in the second left space. When there is dilatation of the right auricle a systolic impulse may be detected in the third right space. *Percussion* reveals increased dulness to the right or left and downward, unless the enlarged heart is overlapped by emphysematous pulmonary tissue. Upon *auscultation* various sounds due to complications may be audible. The characteristic signs are present only in the idiopathic type of dilatation; these are a weak but not impure first sound; at times it may be almost inaudible or reduplicated as a result of lack of synchronous contraction of the right and left sides of the heart and the loud ventriculo-systolic murmur of a relative mitral insufficiency may be present. The second pul-

monic sound is distinct if only dilatation of the left ventricle with hypertrophy of the right is present. It is weak if the dilatation affects the right ventricle. The heart action is irregular, weak and intermittent. A gallop rhythm is typical of dilatation but is not constantly present.

The diagnosis in differentiation from pericardial effusion (see p. 553) may be difficult; from hypertrophy, dilatation may be distinguished by the indefinite, diffuse and undulatory apex impulse, by the weakness and irregularity of the pulse and the lack of accentuation of the second sounds at the base.

The prognosis, while unfavorable as to final result, should be guarded; proper treatment often succeeds to a considerable extent in relieving symptoms and prolonging life.

Treatment. The chief essential is complete rest in bed; under this alone temporary recovery may be brought about in many instances. Cardiac stimulants should be prescribed as in valvular disease with failing compensation (see p. 591). In the acute type of dilatation, venesection may greatly relieve the failing heart, especially if failure of the right heart is present as evidenced by dyspnœa and cyanosis.

The employment of the so-called Nauheim baths and after the acute symptoms have disappeared, of the exercises originated by the Schott brothers and modified by the resistance movements of the Lingg Swedish system of exercises, is often fraught with excellent results. In connection with these the patient's mode of life and diet should be regulated according to the strictest principles and no measure calculated to prevent a recurrence of the dilatation should be omitted.

The Nauheim treatment is, of course, most effectual when undertaken at the springs but artificial imitations of the natural baths may be taken at home and from these excellent results may be obtained. Artificial Nauheim salts are now supplied by the manufacturing chemists or may be made up by any pharmacist, the formula being supplied by the physician. They depend chiefly for their action upon the evolution of carbonic acid gas and may be employed in various strengths.

Bath No. 1. Sodium chloride 4 lbs. (2,000); calcium chloride 6 oz. (180).

Bath No. 2. Sodium chloride 5 lbs. (2,500); calcium chloride 8 oz. (240).

Bath No. 3. Sodium chloride 6 lbs. (3,000); calcium chloride 10 oz. (300).

Bath No. 4. Sodium chloride 7 lbs. (3,500); calcium chloride 10 oz. (300); sodium bicarbonate ½ lb. (250); 25 percent. hydrochloric acid 12 oz. (360).

Bath No. 5. Sodium chloride 9 lbs. (4,500); calcium chloride 11 oz. (330); sodium bicarbonate 1 lb. (500); 25 percent. hydrochloric acid 1½ lbs. (750).

Bath No. 6. Sodium chloride 10 lbs. (5,000); calcium chloride 12 oz. (360); sodium bicarbonate 2 lbs. (1,000); 25 percent. hydrochloric acid 3 lbs. (1,500). The amounts given are suitable for a bath of 40 gallons (160 litres).

A porcelain tub should be used or the salts should be dissolved in earthen

bowls if the tub is of metal. When the salts have been dissolved the bottle containing the hydrochloric acid is inverted and, with its mouth below the surface of the water, the stopper is removed and the acid uniformly mixed with the bath. The patient should now get in at once so as to get the full benefit of the evolution of the carbonic acid gas. The numbers 5 and 6 are seldom prescribed.

In addition to the carbonic acid other beneficial factors possessed by the natural Nauheim baths are the warmth and the fact that it is natural warmth; the presence of alkaline salts and of metals in large quantities; the coincident combination of the carbonic acid gas with the salts and other elements, and a certain amount of electro-magnetism which the waters are considered to hold.

The temperature of the bath at the beginning should be from 92.3° to 95° F. (33.5° to 35° C.) according to the condition of the patient, considering whether he is stout or lean, young or old and whether he is accustomed to cool or warm bathing. The temperature may be gradually lowered 4 to 6 degrees F. (2 to 4 degrees C.) but in most instances rather less than these figures; with some patients a constant temperature is maintained for the greater part of the time.

The patient remains in the bath at first from 4 to 6 minutes; gradually this time is increased to 10 or 12 minutes, exceptionally to 15 or 20. Upon changing the bath for a stronger, the initial duration should be lessened and the maximum time depends upon the patient's condition and his reaction to the measure. The guide to the proper length of a bath, after the first few have been taken, is a change of pulse from a slower and fuller to a more rapid and smaller one or when other signs of weakness are noticed. After the bath the patient should be dried with a warm towel and during the process or shortly afterward he should take a little simple solid or liquid food, he should then rest for about a half hour, during which he may doze but should not slumber deeply for this latter causes a relaxation, during which much of the tonic effect of the bath is lost.

The baths produce the most benefit when given on alternate days and should never be given upon two successive days without an omission upon the third. In rare instances two day rests may be necessary. The strength of the baths may be gradually increased and their temperature slightly lowered, never, however, below 82° F. (27° C.) and seldom to this point.

The number of baths necessary to complete a treatment varies; usually we anticipate a good result from twenty to twenty-five; often it is well to stop the baths when this number has been reached and if the desired effect has not been attained to advise a change of air for a month, the bathing to be resumed at the end of this period.

The physiological effect of the baths results in a slowing of the pulse rate and an increase in its force and a lessening of the dyspnœa, after the first few

moments; in some instances internal congestion is so much relieved that in thin subjects the area of cardiac dulness is diminished showing that the heart has contracted as a result of the greater ease with which it performs its function; the size of the liver is said also to diminish and the amount of hæmoglobin and number of red blood cells to become increased.

Before beginning the exercises we should attain positive benefit from the baths and the employment of massage is advisable before commencing the exercises proper. This massage should consist of a stroking of the limbs from the extremities upward; abdominal massage should be performed with the greatest care since it may cause cardiac depression. These strokings may be continued at first for 5 or 10 minutes, later for 20 minutes and should be followed by a period of rest. Respiratory exercises, in the open air, if possible, if not in a thoroughly ventilated apartment, are very useful. The patient places a cane behind his shoulders and in front of his upper arms and walks about taking regular and deep breaths. After the latter and the massage have been continued for two or three weeks the exercises may be instituted under the following rules: The patient should not hold the breath but should breathe with regularity; exercises which cause an intermittent heart action must be omitted; only moderate resistance should be employed at first; no movements should be used which bring the hands above the level of the shoulders, for raising the hands increases arterial tension and weakness, and retards the heart action. The exercises include all ordinary movements of the limbs and extremities; these are made by the patient against the moderate resistance of the attendant. Lateral and rotatory movements of the body are included. They should never be continued until the patient is tired.

In fatty heart, after a course of the above treatment which has benefited the patient to a sufficient degree, hill and stair climbing in moderation may be prescribed. The walk should at first be short and up only a moderate incline stopping every 10 or 15 yards to rest and to take several full breaths. If the respiration becomes hurried under this exercise it should be omitted; if no untoward symptoms are induced the walks may be gradually lengthened to from 100 feet to five or ten times this distance. Stair climbing, resting for a few breaths every four or five steps, may be substituted in unpleasant weather.

With regard to diet we can lay down no fixed rules. Alcohol should be interdicted except in old persons who have become accustomed to its use. Beer should not be allowed even here, but we may permit a little whiskey or wine with the noon and evening meals. Coffee is best omitted but if tea and cocoa are unpalatable a little very weak coffee may be taken at breakfast. Milk is by far the drink to be preferred, and in arteriosclerosis should comprise the chief part of the diet. Starches should be avoided here but eggs may be allowed. With a fatty heart fats should be forbidden and starches as well;

lean meat, fish and green vegetables may be allowed. Liquids with meals are not permissible but may be taken in the intervals.

Contra-indications to the Schott or Nauheim treatment are chronic nephritis, advanced aneurysm and arteriosclerosis in its late stages. All patients who are afflicted with this stage even in its incipiency must be most carefully watched while undergoing this treatment for often albuminuria and casts in the urine appear which seem to be caused by the baths; these in many instances may yet be continued with benefit to the patient but, as stated above the greatest watchfulness upon the part of the physician is necessary.

CARDIAC ATROPHY.

This condition consists in a diminution in the muscular substance of the cardiac walls and a consequent contraction in the size of the chambers of the organ. It occurs with the chronic wasting diseases, especially tuberculosis and cancer; it is also observed in senile marasmus and occasionally in chronic endocarditis. The reduction in size of the organ is usually symmetrical. Its color is dark brown and its walls are firm in consistence. Under the microscope, granules of a brown pigment are seen about the nuclei of the muscle cells and between the fibrillæ.

The condition causes no special symptoms, only those of the causal disease being present, the pulse is weak and the physical signs consist of a reduction in the normal area of cardiac dulness, weakness of the apex impulse and of the heart sounds. In pulmonary emphysema the lung may overlap the heart so as to diminish its area of dulness, consequently this condition is to be excluded in the diagnosis of cardiac atrophy.

Treatment consists in the employment of the approved measures calculated to benefit the causal affection.

MYOCARDITIS.

Parenchymatous Myocarditis.

Synonym. Parenchymatous or Albuminoid Degeneration of the Heart.

This condition consists of a conversion of the normal muscular substance of the cardiac wall into a granular albuminoid matter soluble in acetic acid but not in æther. Microscopically the striæ of the muscle fibres are indistinct or invisible; on gross inspection the heart muscle is pale and in consistency it is very soft. Parenchymatous degeneration is believed to be the result of some toxic influence and is met in the acute infectious diseases such as small-pox, enteric fever, scarlatina, etc. It is no longer considered to be due to prolonged high temperature and is not a permanent change.

Fatty Myocarditis.

Synonym. Fatty Degeneration of the Heart.

Definition. A degeneration of the heart muscle characterized by the replacement of the normal tissue by fat.

Ætiology. Fatty myocarditis occurs as a result of prolonged acute infections, in the chronic wasting diseases, especially pernicious anæmia, as a senile change, in phosphorus and arsenic poisoning, in pericarditis and with sclerosis of the coronary arteries. The hypertrophied and dilated heart of chronic endocarditis may undergo fatty degeneration.

Pathology. The replacement of normal muscle by fat may be localized in one part of the organ or generalized; most frequently it affects the left ventricle. In the former instance there may be small foci of fat in the muscle immediately underlying the pericardium; these may occur only in the layers subjacent to the myocardium or, as a result of thrombosis or embolism of a branch of the coronary artery, an isolated focus of fatty metamorphosis may be found in the wall of the left ventricle or in the inter-ventricular septum; this at first is hæmorrhagic or brownish and later becomes white and is known as a white infarct or an area of anæmic necrosis. This may finally disintegrate and be replaced by caseous matter or, weakening the cardiac wall, may result in rupture. General fatty myocarditis is evidenced by a dilatation of the organ; it is soft and flabby, light yellowish-brown in color and little force suffices to tear its walls; there may be deposits of fat in the papillary muscles. Under the microscope, fat droplets are seen along the margins of the muscle fibres; in marked instances the fat may almost entirely replace the muscular tissue. With the fatty degeneration of the myocardium there may be a similar condition in the solid viscera and in the muscular fibres of the diaphragm.

Symptoms. These may be *nil* so long as dilatation does not supervene, and upon the incidence of this complication it is responsible, rather than the fatty change in the heart wall, for the clinical manifestations which occur. These are those of dilatation occurring from any cause—dyspnœa, palpitation, irregular and feeble heart action, etc.

The prognosis of the condition is unfavorable, no therapeutic measures being able to influence the pathological condition which is permanent.

Treatment. This is identical with that of cardiac dilatation—rest in bed and stimulation for the acute attacks and later, or before these appear, if the diagnosis is made so soon, the Nauheim or Schott method (see p. 561) is indicated.

Fatty Infiltration of the Heart.

Synonyms. Fatty Over-growth; *Cor Adiposum.*

This condition consists in an increase of the normal sub-pericardial fat but

finally the myocardium may be involved, the fat making its way between the muscular fibres of the heart wall even as far as its endocardial lining. It is usually associated with obesity and is a disease occurring in late middle life and affecting males more than females. The fatty change ultimately interferes with the nutrition of the organ and impairs its action. Here the symptoms are those of true fatty myocarditis. In the earlier stages the symptoms are those of cardiac insufficiency associated with obesity.

The treatment is that of obesity and fatty myocarditis.

Amyloid degeneration of the heart has been observed. The pathological change involves the walls of the blood-vessels and the inter-muscular connective tissue.

Hyaline degeneration (Zenker) affects the muscle fibres, rendering them swollen and transparent and partially or wholly obliterating their striæ.

Calcareous degeneration occurs rarely, being characterized by an infiltration of the muscular tissue with calcium salts.

Fibrous Myocarditis.

Synonyms. Fibro-myocarditis; Interstitial Myocarditis; Fibroid Heart; Coronary Arteriosclerosis.

Definition. A condition in which the normal muscular tissue of the heart is to a greater or less extent replaced by fibrous tissue.

Ætiology and Pathology. Fibrous degeneration of the heart wall is the result of sclerosis of the coronary arteries, consequently the causes of fibro-myocarditis are those of coronary arteriosclerosis and these are those of endarteritis in general (see p. 606). Disease of the coronary arteries diminishes the blood supply of the heart muscle which results in a gradual degeneration of the muscular fibres which are finally replaced by sclerotic tissue. This change is most frequently observed in the wall of the left ventricle near the apex or in the septum, but may take place in any part of the cardiac muscle.

Disease of the coronary arteries also leads to the occurrence of areas of anæmic necrosis in the heart wall as a result of thrombosis or embolism. These areas are yellowish in color, may be conical in shape and may project beyond the surface of the organ. They at first soften and become degenerated, later they undergo sclerotic or hyaline changes.

With the fibrous degeneration of the heart muscle valvular lesions may co-exist which may be a factor in the production of the fibrosis because of the resulting venous congestion, or emboli from the valves may find their way into the coronary arteries and cause anæmic infarcts. The lodgment of infective emboli from any source, in the coronary arteries gives rise to septic infarctions

which become abscesses of varying size. Small ones may give no symptoms but larger ones may either perforate internally or outwardly into the pericardium—the so-called acute cardiac ulcer.

Symptoms. In the mild degrees of fibrosis there may be no symptoms and the disease may be of such degree as to cause sudden death in a subject who has never considered his heart diseased. The association of endocarditis with myocarditis may obscure the symptoms of the latter. When occurring independently fibro-myocarditis is evidenced by the ordinary symptoms of cardiac dilatation (see p. 547), dyspnœa, palpitation, rapid or constantly slow pulse, arrhythmia and often Cheyne-Stokes respiration at night. Late manifestations are those referable to general venous congestion such as œdema, cyanosis, etc. Anginoid attacks may occur and marked mental symptoms, due to circulatory changes in the brain, may be observed.

Physical Signs. The apex impulse is usually weak and may be found with great difficulty, unless dilatation is present, when its area is diffuse; the area of cardiac dulness is diminished in size. The quality of the first sound at the apex is less clear than normal and in the later stages both first and second sounds become diminished in intensity. A ventriculo-systolic murmur may be present at the apex, this murmur is less constant than that of mitral insufficiency and is not accompanied by an accentuation of the pulmonic second sound, which latter may be reduplicated.

The diagnosis is not easy; the frequent presence of associated valvular lesions does not tend to simplify matters; when we find a manifestly diseased heart, in which no murmurs are heard and general arteriosclerosis is present, in a subject beyond middle life, we are usually safe in diagnosticating fibrous myocardial degeneration.

The prognosis is unfavorable yet life may be sustained for long periods and in comparative comfort; the accompanying disease of the coronary arteries, however, renders sudden death, due to blocking of these, possible at any time.

Treatment. An endeavor to promote the absorption, or at least to prevent the further production of fibrous tissue in the walls of the coronary arteries may be made by administering iodine. The syrup of hydriodic acid—℥i (4.0) in a wine glass of water one-half an hour before meals—or potassium iodide, the latter having a vaso-dilator action, may be employed. The patient's mode of life should be regulated just as in the treatment of arteriosclerosis (see p. 595), alcohol and tobacco should be forbidden and over-eating and over-work avoided. The vessels may be kept open if tension is present, and the tendency to heart weakness and venous congestion combated by the same means as those mentioned under the treatment of cardiac dilatation. Rest in bed is often a very necessary adjunct to treatment. Digitalis should not be prescribed for patients who have a constantly slow pulse and an increased

vascular tension. The treatment by means of Nauheim baths, massage and resistance exercises (see p. 561) in properly selected patients will prove of great benefit.

ACUTE SUPPURATIVE MYOCARDITIS.

Synonym. Cardiac Abscess.

In pyæmic states infective emboli may lodge in the branches of the coronary arteries, as previously stated, and cause abscesses. These may be very tiny, in which case they usually cause no symptoms, or of larger size; in the latter instance they may rupture into one of the chambers of the heart or externally into the pericardial sac. In the former case the blood current takes up the infectious matter and scatters it through the body to cause other embolic abscesses; in the latter suppurative pericarditis and death result.

ANEURYSM OF THE HEART.

Cardiac Aneurysm occurs in two forms:

a. Valvular aneurysm which may take place in acute endocarditis as a result of weakening of a localized area in one of the valvular segments through ulceration. Rupture may take place through the weakened area or the pressure of the blood may cause an aneurysmal dilatation upon the ventricular surface of the flap. Rupture of such an aneurysm results in insufficiency of the affected valve. The aortic is the valve most often affected.

b. Aneurysm of the cardiac wall may be caused by injury or occur as a result of weakening due to myocardial degeneration. Its most frequent site is in the wall of the left ventricle near the apex. The weakened wall bulges and the resulting dilatation varies in size from that of a good sized pea to that of the heart itself. Succulation and multiple aneurysms have been observed. Rupture into the pericardium may take place.

The symptoms are not definite and the condition is not likely to be diagnosticated with any certainty during life.

RUPTURE OF THE HEART.

Rupture of the cardiac wall may take place as a result of almost any disease of this structure but is most frequent in fatty myocarditis with white infarct. It has also been observed in fibrous degeneration of the heart muscle, abscess, malignant neoplasm and gumma. It is most common in the aged but has been noted in infants; it is usually induced by over-exertion but may take place spontaneously and without symptoms of warning. The favorite site of the rupture is the anterior wall of the left ventricle near the septum.

Death from rupture may take place immediately or, exceptionally, life may be prolonged for a few hours. In this case the patient suffers from oppression, dyspnœa, cardiac pain and collapse. Physical examination should reveal the signs of a pericardium distended with fluid.

DISEASES OF THE ENDOCARDIUM.

ACUTE ENDOCARDITIS.

Definition. An acute inflammation of the membrane lining the heart, usually confined to that portion which covers the valves, and characterized by the development upon these structures of vegetations with loss of valvular substance. It is often and properly termed valvulitis. In rare instances the lining of the heart's chambers may be involved.

Acute endocarditis occurs in two main types, the *mild* or *simple* and the *malignant, infective* or *mycotic;* there is, however, no distinct line of demarcation to be drawn between these two types from a pathological standpoint, they differ merely in severity. Both are the result of infective processes and it is difficult to state why in one instance the mild form is met and in another the malignant.

Ætiology. *Simple acute endocarditis* is always a secondary affection, most often to acute articular rheumatism; in many instances, also, it occurs with chorea; less frequently it complicates the acute infectious diseases, especially scarlatina and pneumonia, while it is less commonly seen in tonsillitis, erysipelas, smallpox, diphtheria and enteric fever; in measles and varicella it is rare. It is also met in chronic nephritis and the chronic wasting diseases such as tuberculosis, cancerous cachexia, diabetes and gout, and in addition it is often engrafted upon the sclerotic valves of chronic endocarditis, causing acute exacerbations of the symptoms of the latter inflammation; the term recurrent endocarditis has been applied to this form of the affection.

The bacteriology of simple acute endocarditis following the infectious diseases is identical with that of the malignant type of the disease.

Cultures from the valves in acute endocarditis due to the chronic diseases are usually sterile. It is possible that micro-organisms have been previously present but have disappeared or that the pathological condition is the result of toxic substances.

Malignant endocarditis is also of infectious nature and may occur primarily in rare instances; much more often it is a secondary affection, being met most frequently in infectious pneumonia, acute articular rheumatism, gonorrhœal infection, peliosis rheumatica, puerperal fever and other forms of septicæmia, and is distinctly predisposed to by chronic valvular lesions and congenital cardiac defects. It is rare in chorea, tuberculosis, scarlatina and the other

acute infectious diseases. The bacteria most often found in the valvular lesions are the pneumococcus, the gonococcus, the staphylococcus and the streptococcus. Rarely typhoid, tubercle and colon bacilli have been noted. Mixed infections may occur.

Pathology. The morbid changes affect the left side of the heart in the great majority of instances. The mitral valve is most often involved, then the aortic, next the tricuspid and last the pulmonary valve. The characteristic lesion is the occurrence of warty vegetations upon the valves and more rarely upon the membrane lining the cardiac cavities. Upon the mitral and tricuspid valves they are observed upon the auricular surfaces near their margins and upon the aortic and pulmonary valves upon the ventricular aspects. They are $\frac{1}{12}$ to $\frac{1}{8}$ of an inch (2 to 3 mm.) in height, of irregular surface and may be pediculated. At their inception they consist of cells proliferated from the adventitia and connective tissue of the outer layers of the endocardium. These cells are infiltrated with red and white blood cells and fibrin which finally organize and the vegetation becomes wholly composed of connective tissue, bits of which may become detached and carried as emboli by the blood current. Micro-organisms are usually found enmeshed in the fibrin which often forms a film over the summit of the vegetation. The latter may undergo subsequent contraction and organization and disappear, not, however, leaving behind a normal valve, but one thickened, sclerosed and contracted, or the inflammatory process may continue and go on to an endocarditis of malignant type.

In *malignant endocarditis* vegetations are almost constantly present. These vary in size from that of a pin-head to that of a pea and frequently undergo ulceration which may go on to the formation of a valvular aneurysm or to perforation. The endocardial lining of the cardiac chambers also may be affected, most frequently in the left ventricle at the upper part of the septum. The vegetations in this type of endocarditis contain pathogenic bacteria in greater number than in the simple form and these are closely intermingled with masses of fibrin. The process when involving the endocardial lining may go on to perforation of the heart wall. According to Osler's statistics of 209 patients the mitral valve alone is most often affected, next the aortic, next both the mitral and aortic, next the mural endocardium, next the tricuspid and lastly the pulmonary valve. Extension of the inflammatory process may take place along the pulmonary artery to the hilum of the lung or to the aorta producing multiple aneurysmal dilatations. Further than this the pathological changes consist of those due to the primary infection, pneumonia, rheumatism, sepsis, etc., and the lesions due to the lodgment of emboli deposited in various parts of the body by the blood current. These result in the formation of metastatic abscesses or red infarctions. Emboli may be absent or be numbered by hundreds. They may be situated in the spleen,

kidney, brain, skin or intestines, and, in endocarditis of the right heart, in the lungs.

Symptoms. Those of *acute simple endocarditis* are in no way typical and are frequently overlooked, the first intimation of cardiac involvement being the presence of vegetations as revealed upon the autopsy table. The symptoms of the primary disease are present and in those affections in which endocarditis is prone to occur, daily examinations of the heart should be made. When cardiac involvement occurs it may be evidenced by an increased rapidity and an irregularity of heart action, dyspnœa, augmented restlessness and fever. Cardiac pain is rare; palpitation is frequent. The febrile movement is not marked—101° to 102° F. (38.4° to 38.9° C.).

The physical signs are not characteristic but it is usually upon these that the diagnosis is based. In the earlier attacks the size of the heart is not increased, the apex impulse being usually in the normal site (fifth left interspace, 3¼ inches from the mid-sternal line), murmurs due to the valvular lesions (see p. 576) may be present but do not in every instance signify an involvement of the endocardium; a ventriculo-systolic *bruit* at the apex often being the result of a myocarditis; basic murmurs of functional character should not be mistaken for true organic sounds.

An increasing roughness in the first sound at the apex changing to a distinct murmur may be an evidence of endocarditis, and accentuation and reduplication of the pulmonic second sound are not infrequent. Endocardial murmurs are often inconstant.

The symptoms of *malignant endocarditis* are also indefinite but in most instances the irregular fever, chills and sweats of sepsis, cerebral symptoms and prostration are present. Particularly should we suspect this condition when these symptoms appear with pneumonia, in the puerperium, etc., and the heart should be carefully examined for physical signs. Symptoms of embolism throw much light upon the diagnosis; with cerebral embolism paralyses, delirium or coma may be observed; increase in the size of the spleen with sudden pain referred to this organ, pain in the lumbar region with bloody urine, the occurrence of metastatic abscesses, impaired sight from retinal embolism, are characteristic manifestations. The temperature may be remittent or continuous, fever is, however, a constant symptom; hæmorrhagic and erythematous rashes are not rare. Cardiac symptoms such as dyspnœa, palpitation and oppression are inconstant, but the pulse and respiration are increased in rate. Jaundice may be present, and albuminuria with casts is the rule. Clinically the affection may be considered as occurring in three types:

a. The septic or pyæmic type which is usually associated with wounds, puerperal or other sepsis, and gonorrhœal infection. Here the symptoms are characteristic of septicæmia, and the chills, sweats and irregular fever may wholly mask any cardiac manifestations unless embolism occurs. The tem-

perature may resemble that of quotidian or double tertian malaria. The leucocytes are increased and pathogenic micro-organisms may be cultivated from the blood.

b. The typhoid type is characterized by a gradual onset, a temperature curve resembling that of enteric fever, sweats, a rash not unlike that of typhoid, prostration, drowsiness, tympanites and abdominal tenderness, diarrhœa, the typhoid tongue and often no cardiac symptoms. This is the most common form.

c. The cerebral type is evidenced by delirium or coma and other symptoms resembling those of a basilar or cerebrospinal meningitis.

The physical signs are atypical. Murmurs may or may not exist and when detected may be inconstant and difficult to locate and time with accuracy; co-existent pericarditis and primary chronic endocarditis may still further complicate matters.

The diagnosis is often difficult; in all fevers of septic type daily and most careful examination of the heart should be performed. The occurrence of embolism renders the diagnosis much more simple. From enteric fever the condition may be separated by its less enlarged and more tender spleen, by the presence of leucocytosis and by the absence of the Widal reaction; the writer recollects a patient seen several years ago who came to autopsy with a diagnosis of enteric fever in whom typical valvular vegetations were found and in whom the Widal reaction was negative. It must not be forgotten that infarction may rarely occur in enteric fever. Malaria may be excluded by blood examination. Cultural blood tests in endocarditis usually reveal the presence of pathogenic micro-organisms.

The prognosis in simple acute endocarditis is good as to recovery but seldom is the heart left undamaged; rarely, however, this may occur. The fact that the murmur has disappeared is by no means an assurance that the valves are intact and it is not to be forgotten that successive attacks are not infrequent.

In malignant endocarditis the outcome is invariably fatal although the course of the disease may be prolonged for months; this may take place when the infection is superadded to a chronic valvular defect; the symptoms are a persistent temperature with progressive emaciation and weakness, until at the last embolic manifestations may occur. The usual instance terminates within a month to two weeks. One instance fatal in two days has been reported.

Treatment. *Of acute simple endocarditis.* Unfortunately we possess no therapeutic measure whereby we can cause a return of the diseased valve to its normal condition, consequently we should endeavor to prevent in so far as possible the occurrence of the endocardial lesion. Rheumatism, being the most frequent cause, we should advise all individuals of rheumatic tendency to avoid exposure, to wear proper clothing and to maintain as high a standard of bodily nutrition as possible. Rheumatism being present, while it is by no

means certain that in the salicylates we have a means of preventing the incidence of endocardial inflammation, it should receive early and thorough treatment by the salicylates and alkalies (see p. 117). Where cardiac involvement is present or there is any likelihood that it will occur, absolute rest in bed should be insisted upon; it is as important to keep an inflamed valve as nearly at rest as possible as it is to immobilize an inflamed joint. The confinement to bed should be prolonged for several months if necessary. Blisters over the heart are of doubtful value but if the action of the organ is too rapid or violent our best means of inducing quiet is by the application of the Leiter coil or the ice bag, preferably the former as it is more comfortably borne by the patient. If the circulation becomes depressed hot compresses should be substituted for the cold. The drug of most use as a heart tonic and which should be administered as soon as signs of weakness are evident, is strychnine. It may be given in doses of $\frac{1}{60}$ to $\frac{1}{20}$ of a grain (0.001 to 0.003) 3 times a day. Aconite has been recommended as useful in conditions of over-action but is depressant and altogether less advantageous than the application of cold. Dyspnœa may be relieved by the administration of opium or morphine which act as heart tonics in addition. Pain is not a common symptom but may be combated if necessary by these drugs also, the coal tar analgesics possessing too depressing an action. Fever seldom requires special treatment but may be relieved by cool sponging. Restlessness and sleeplessness may be controlled by the bromides or sulphonmethane (sulphonal).

The administration of the iodides is advocated in the hope that these may influence the tendency to the production of permanent connective tissue changes in the valves and it is possible that they may prove beneficial. Preferably we should give a drachm (4.0) of the syrup of hydriodic acid three times daily, one-half an hour before meals in a wineglass of water, but potassium iodide may also be employed in doses of 10 grains (0.66) three times a day. This treatment should be continued for a long time if it is to accomplish any result.

Throughout the disease the bowels and kidneys should be kept active and much benefit will accrue if the action of the liver is stimulated from time to time by a few fractional doses of calomel followed by a saline.

The diet should be nourishing, easily digestible and above all such as not to cause tympanitic distention of the stomach and intestines which will greatly interfere with the heart's action. Broths, meat juices, eggs, milk and the like may be allowed. Frequent small meals are much to be preferred to fewer and larger ones.

The treatment of *malignant endocarditis* consists first in the removal of the cause by surgical means when this is apparent and operation is practicable. The septic uterus should be cleaned out, foci of bone necrosis excised, etc.; rheumatism, if the causal factor, should receive proper treatment; metas-

tatic abscesses when they occur should be opened and drained if in such location as to render this possible. The general management of this type of acute endocarditis is in other respects similar to that of the simple form; anti-streptococcus serum should be administered, for, while the results up to this time obtained by the employment of this agent have not been markedly encouraging, in some few instances benefit has been conferred, and at any rate no harm can be done. The ordinary daily dose is about 5 drachms (20.0) given hypodermatically. When the infection is the result of the presence of pneumococci, gonococci or any pathogenic bacteria save those of suppuration, it is not to be expected that this treatment will do good.

Beer yeast has accomplished encouraging results in septic infections of various types and its use has been suggested in septic endocarditis. It may be given by mouth, rectum or under the skin. The antiseptic action of the colloidal silver salts should benefit the septic condition obtaining in this affection, consequently we may employ generous inunctions of Credé's ointment.

CHRONIC ENDOCARDITIS.

Synonym. Chronic Valvular Disease of the Heart.

Definition. A permanent sclerotic change in the cardiac valves characterized by thickening, shrinkage, adhesions and calcification of the flaps and their chordæ tendineæ and resulting in obstruction or insufficiency of the cardiac orifices.

Ætiology. Chronic endocarditis is rarely a primary affection; in most instances the condition is secondary to acute endocarditis of rheumatic or other origin. Other causes are chronic alcoholism, gout, syphilis, plumbism, prolonged muscular over-exertion and rheumatism and other acute infections. The sclerotic change which occurs in all connective tissue structures as a result of senility renders old age a predisposing factor. Men are more prone to the disease than women.

Pathology. The initial change is a thickening of the valve which begins at the edges of the cusps and is due to an increase in the normal connective tissue at this situation; while this change is of slight degree the function of the valve may be undisturbed but the process continues to advance until the entire cusp is thickened and stiffened. Later the newly produced tissue shrinks which causes the valve flap to retract and to become partly immobilized. This shrinkage may involve the chordæ tendineæ as well as the valve proper in which case the retraction is more marked and perfect closure of the valve becomes impossible. Adhesions between the cusps now form, still further interfering with their action; particularly in the mitral valve is this likely to be a serious condition since it may reduce the mitral opening to hardly more than a slit. Further changes are the deposition of lime salts which may result in stiffening of the valves or in the formation of hard nodules pro-

jecting from their margins; in extreme degrees the fibrous ring of the valve becomes infiltrated with the calcareous substance and as a consequence is rigid and almost bony. Fatty degeneration is evidenced by yellow areas upon the valvular surfaces or margins. Fibrous changes may involve the apices of the papillary muscles and there may be sclerotic patches in the endocardial lining of the walls of the heart. With the changes of chronic endocarditis the vegetations of an acute process may also be present.

Congenital valvular defects may be due to malformations or to inflammatory processes occurring in the fœtus. Such lesions most frequently affect the right side of the heart; rarely they may be observed in the left side.

The different valves are affected in the following order of frequency: (1) The mitral; (2) the aortic; (3) the tricuspid; (4) the pulmonic. Lesions of more than one valve often co-exist.

Mitral Insufficiency.

This is the most common valvular lesion. The incompetent valve allows the blood to regurgitate from the left ventricle into the left auricle during the heart's systole; the endeavor of the auricle to prevent this back flow results in hypertrophy, and ultimately in dilatation and the backward rush of blood to the lungs results in congestion of these organs. Further changes now take place in the right side of the heart, hypertrophy of the right ventricle is induced by its effort to overcome the pulmonary congestion; this it is able to do for a time and during this period the right ventricle is able to pump an excessive quantity of blood through the lungs to the left ventricle and compensation is furthered by a hypertrophy of the walls of this structure which now ensues. At length, however, the strain becomes too great for the right ventricle, it dilates, producing a relative insufficiency of the tricuspid valve, regurgitation into the right auricle follows with further backing up of the blood current into the great veins of the neck and finally a general systemic venous congestion takes place.

By the term "relative insufficiency" employed above is meant a condition of valvular incompetency, due to no pathological lesion of the valve, but occurring as the result of the dilatation of a heart cavity and consequently of its orifices which the normal-sized valves become of insufficient size to close. This form of leakage is observed most often in the auriculo-ventricular valves and may not be detected during life since physical signs may be wholly absent.

Ætiology. Mitral insufficiency is the result of changes in the cusps of the valve, whereby they are retracted and shrunken, with associated sclerosis of the chordæ tendineæ or of dilatation of the ventricular wall in which latter case the insufficiency is of the relative type. The initial cause of the valvular incompetency is an acute or chronic endocarditis.

Symptoms. While compensation is sufficient to overcome the effects of the regurgitation of blood through the leaking valve these are often wholly absent, unless there is a sudden rupture of a cusp due to ulceration. While compensation is still good the patient may complain of slight palpitation and dyspnœa on exertion and facial congestion and clubbing of the fingers may be present. The initial symptoms of failing compensation are increasing dyspnœa and accompanying palpitation with irregularity. Symptoms due to the congestion are now present; these are cough with mucoid and perhaps bloody sputum; attacks of bronchitis are frequent, to which the pulmonary engorgement predisposes. Congestion of the alimentary tract results in digestive disorders with nausea and perhaps vomiting, congestion of the liver causes enlargement and sometimes jaundice, tenderness, pulsation, and secondary increase in the size of the spleen; to congestion of the kidneys is due albuminuria, with hyaline casts and in some instances red blood cells; the urine is usually diminished in quantity. Œdema, usually first involving the feet and ankles, now appears and spreads to the subcutaneous tissue of other parts of the body and into the serous cavities, especially the peritonæum and pleura.

Physical Signs. *Inspection* reveals an apex impulse displaced downward and to the left, it is usually more forcible than under normal conditions and if dilatation is in excess of hypertrophy it is diffuse and undulatory. In emaciated and young subjects the precordium may bulge and an impulse due to the systole of the right ventricle may be visible below the ribs in the left parasternal line; pulsation in the veins of the neck may be present.

Palpation confirms the signs disclosed by inspection; the apical impulse is increased in force; a ventriculo-systolic thrill may be detected at the apex in very rare instances.

Percussion reveals an area of cardiac dulness increased to the left, and when the right ventricle is enlarged, beyond the right border of the sternum.

Auscultation. The characteristic murmur of mitral insufficiency is a ventriculo-systolic murmur, soft and blowing, and heard with greatest intensity at the apex; it is transmitted toward the axilla and often is audible in this

TIME.	PLACE.	LESION.
Auricular systole	At apex	Mitral obstruction
	At xiphoid cartilage	Tricuspid obstruction
Ventricular systole	At apex	Mitral insufficiency
	At xiphoid cartilage	Tricuspid insufficiency
	At 2d right cartilage (aortic area)	Aortic obstruction
	At 2d left interspace (pulmonic area)	Pulmonic obstruction
Ventricular diastole	At aortic area	Aortic insufficiency
	At pulmonic area	Pulmonic insufficiency

Table of heart murmurs giving the time at which the murmur occurs, the place at which it is heard with maximum intensity and the lesion causing the murmur.

situation and posteriorly at the level of the apex and between the scapula and the vertebral column; when very loud it may be heard over the entire chest; it may wholly or partly obliterate the first sound at the apex. If compensation has failed and dilatation has taken place the murmur may disappear and be replaced by atypical valvular sounds. It may not be present in all instances of mitral insufficiency but it may be rendered audible, in many instances where it is apparently absent, by muscular exertion. A ventriculo-systolic thrill is very rare.

An important sign is an accentuation of the pulmonic second sound heard in the second left space close to the sternum; this is due to the increased tension in the pulmonary artery. If there is marked left ventricular hypertrophy the aortic second sound will also be increased in intensity.

The pulse is practically normal in the stage of full compensation; upon the onset of failure of compensation it becomes irregular in force and frequency; the irregularity may continue after the re-establishment of compensation.

The diagnosis. A ventriculo-systolic murmur, loudest at the apex, and transmitted into the axilla, accompanied by other signs of cardiac dilatation and hypertrophy and an accentuated pulmonic second sound, is characteristic of mitral insufficiency; unfortunately there are murmurs similar in character and transmisson which are of doubtful origin but are certainly not the result of valvular defect; these may be functional or are caused by some little understood ventricular condition. They are not associated with dilatation or hypertrophy or an increased pulmonic second sound. The ventriculo-systolic murmur of aortic obstruction may be loudest at the apex but is not transmitted to the left nor accompanied by an accentuated pulmonic second sound. The ventriculo-systolic murmur of tricuspid insufficiency is heard with greatest intensity at the xiphoid cartilage. An associated rumbling auriculo-systolic murmur of mitral obstruction is more likely to be present in true than in relative insufficiency.

Mitral Obstruction.

Obstruction of the mitral orifice is in almost if not quite all instances accompanied by mitral insufficiency. Obstruction to the free passage of blood through the valve is the result of thickening and shrinkage of the mitral ring, of the cusps and of their chordæ tendineæ. The blood prevented from freely passing into the left ventricle distends the left auricle, which becomes hypertrophied, and is backed into the pulmonary circulation, the right ventricle and finally the general venous circulation. Hypertrophy of the left ventricle is conspicuously absent. Compensation may prevent the appearance of symptoms for a long period of time but untimately relative tricuspid insuffi-

ciency and systemic congestion occur. In the milder degrees of mitral obstruction the orifice may allow the passage of a finger while in the more extreme instances it may be almost wholly obliterated or reduced to a mere slit—the button-hole stenosis of Corrigan. In the slightest grades of obstruction where the edges of the flaps are adherent to one another the orifice is funnel-shaped. The chordæ tendineæ may be so shrunken that the papillary muscles seem to be inserted directly into the flaps. The heart is seldom more than slightly enlarged, the increase in size affecting chiefly the left auricle and right ventricle.

Ætiology. Mitral obstruction is more commonly seen in young persons, especially females. The condition may rarely be congenital but is usually the result of an acute or chronic endocarditis. Certain apparently idiopathic instances may be the result of whooping cough or of some other acute infectious disease.

Symptoms. While compensation is present these are absent; after it has failed they are practically identical with those of mitral insufficiency.

Physical Signs. The lesion may exist for a long time without physical signs, the typical murmur of this condition being a notoriously inconstant one. Upon *inspection* the apex impulse, left ventricular hypertrophy being absent, is seldom found displaced. If hypertrophy of the right ventricle is present the apex beat may be slightly to the left of and below its normal position and pulsation may be noticed just below the ensiform cartilage. The hypertrophied left auricle may produce an impulse, auriculo-systolic in time, in the second left interspace close to the sternum. After the failure of compensation a jugular pulsation may be visible due to a relative tricuspid insufficiency, and with this, hepatic pulsation may be observed. Bulging of the lower part of the sternum and of the fifth and sixth left costal cartilages, due to enlargement of the right ventricle, may occur in poorly nourished children.

Palpation reveals the absence of increased force in the apex impulse, and if compensation is disturbed, this may be weaker than normal, a palpable impulse may be present just below the ensiform cartilage and to its left as a result of right ventricular hypertrophy. A very typical sign is a distinct auriculo-systolic thrill which is often to be felt at the apex or just to the inside of this point. It is localized, rough in quality and often stops, with a sudden shock, with the occurrence of the apical impulse. This thrill is not constant but is pathognomonic of mitral obstruction.

Percussion shows an enlargement of the area of cardiac dulness toward the right due to increase in the size of the right ventricle and to the left as a result of the hypertrophy of the left auricle. The cardiac enlargement is seldom very marked.

Auscultation. The characteristic murmur of simple mitral obstruction (see p. 576) is an auriculo-systolic murmur, usually rather sharply localized at the cardiac apex and slightly to its inner side; rarely it may be transmitted

upward or heard posteriorly. In quality it is rumbling, rough, or purring, and its loudness increases until it terminates suddenly with the apical first sound; it is synchronous with the thrill spoken of above. The pulmonic second sound is accentuated as a result of the hypertrophy of the right ventricle; no left ventricular hypertrophy being present, the aortic second sound is not intensified but there may be duplication of the second sound at the base due to asynchronous closing of the pulmonic and aortic valves.

The pulse in extreme mitral obstruction is characteristically small; in the slighter grades of the lesion it may be unchanged. With the onset of failing compensation the apical murmur and thrill may disappear but the forcible first sound may persist. The heart action becomes irregular and the gallop rhythm may occur; there may be more apex beats than palpable radial pulsations, the so-called *pulsus bigeminus*, here the sphygmographic tracing may show a small ascent between two higher ones.

The diagnosis of uncomplicated mitral obstruction, with the characteristic auriculo-systolic thrill and rumbling murmur which stops abruptly with the impact of the apex against the chest wall, and with an accentuated pulmonic second sound and a small pulse, is not difficult. A tricuspid stenosis, which is a very rare and usually congenital lesion, may be evidenced by a harsh murmur beginning at the aortic closure and covering the ventricular diastole and auricular systole, but it is heard over the xiphoid cartilage, not over the apex. A murmur taking place during ventricular diastole and auricular systole, heard over the apex and at the second right space, the first half of which is harsh, the second half soft, is due to mitral obstruction associated with aortic insufficiency. The so-called Flint murmur, which is rough in quality, auriculo-systolic in time and is heard over the apex, is due to aortic insufficiency and is accompanied by the water-hammer pulse and hypertrophy of the left ventricle and is not associated with the sharp, forcible apical impact. This last is also absent in the rumbling sound sometimes heard in adherent pericardium. The fact that the pressure of the hypertrophied left auricle may cause pressure paralysis of the left recurrent laryngeal nerve should not be forgotten in connection with the diagnosis of aortic aneurysm. With the murmur of mitral obstruction the soft ventriculo-systolic murmur of mitral insufficiency is frequently present.

In obstruction of the mitral valves there are likely to be recurrent attacks of valvulitis during which emboli may be dislodged and cause various cerebral disturbances.

Aortic Insufficiency.

This lesion may be the result of an enlargement of the aortic orifice which the valve flaps cannot close or of changes in the cusps themselves; it is the most grave and most resistant to treatment of the valvular defects. Its

immediate result is a backward flow of blood into the left ventricle during its diastole; this causes the ventricle to dilate and later to hypertrophy in order to restore the balance disturbed by the leakage. The over-developed ventricle forces the blood into the aorta with such vigor that it is fully distended but it is rapidly emptied by the back flow of blood through the incompetent aortic valve and the onward flow into the arterial circulation. This results in the characteristic pulse of this lesion, a pulse of quick and extreme rise and sudden fall. The left ventricular hypertrophy is often accompanied by enlargement of the left auricle and right ventricle. Dilatation and hypertrophy are seen in this lesion in their most extreme type and the heart of aortic insufficiency on account of its great size has been termed the *cor bovinum*. It often weighs as much as 35 ounces (1050.0) and has been known to reach 50 ounces (1500.0). The cavities of the organ are enlarged and there may be co-existent coronary arteriosclerosis with consequent fibrous myocarditis. During life there may be signs of an aortic arch dilated as a result of the continued high pressure exerted by the blood current, but the vessel may be found of normal size after death. As a result of the ventricular enlargement relative mitral insufficiency occurs and ultimately the compensation established by the hypertrophy of the right ventricle fails, relative tricuspid insufficiency takes place and general venous congestion with its concurrent symptoms supervenes.

Ætiology. Aortic insufficiency occurs as a result of congenital defects, particularly union of two of the cusps; of acute or chronic endocarditis; and of sclerosis of the valve which is predisposed to by prolonged excessive muscular exertion, the abuse of alcohol, and syphilis; dilatation of the ascending aorta or aneurysm causes an enlargement of the valvular ring which results in relative insufficiency.

Symptoms. During the stage of compensation there may be no manifestations which give rise to suspicion that any cardiac affection is present. Disturbance of compensation is evidenced by headache, vertigo and a sensation of faintness, especially marked if the patient rises suddenly, and even before the failure of compensation, pain may be a distressing symptom; this may be dull, aching and referred to the precordium or it may be sharp, radiating up toward the neck or down the arms, more particularly the left. Attacks of angina pectoris may occur. Dyspnœa with palpitation, at first only upon exertion but later appearing spontaneously, especially at night and rendering it necessary for the patient to sleep with his head elevated, is common. Œdema is frequent but cyanosis is rarely seen. Pulmonary congestion causes cough, attacks of œdema and perhaps hæmoptysis. The patient may complain of a distressing throbbing in the head, unpleasant dreams and troubled sleep; marked cerebral symptoms such as hallucinations and delirium with suicidal tendencies may be observed. Embolism is not uncommon and

sudden death is more likely to take place in this than in any other valvular lesion; usually it occurs during an unusual exertion and is probably caused by interference with the coronary circulation either as a result of embolism or the fact that the valvular incompetence prevents the proper supply of blood from reaching the heart muscle. An acute ulcerative valvulitis may be engrafted upon an insufficient aortic valve. Anæmia is frequently observed in patients suffering from this lesion.

Physical Signs. Inspection may reveal, especially in young and emaciated individuals, a bulging precordium. The apex impulse is displaced downward and to the left even as far as the seventh space and the anterior axillary line; if compensation is disturbed the apex beat is diffuse and heaving. The nails may blanch with the diastole (Quincke's sign). *Palpation* confirms these signs and rarely may detect a ventriculo-diastolic thrill at the base or in the epi-sternal notch. There may be a ventriculo-systolic depression of the intercostal spaces near the sternum due to atmospheric pressure.

Percussion shows a heart of greater size than is found in any other valvular defect. The cardiac dulness is increased downward and to the left as a result of the left ventricular hypertrophy and, in extreme instances, enlargement exists upward and to the left as well, in which case it is due to upward enlargement of the left ventricle and increase in the size of the left auricle.

Auscultation detects the characteristic murmur of the lesion, ventriculo-diastolic in time, and of greatest intensity over the second right space close to the sternum or at this level over the mid-sternum. It is also in frequent instances loudly audible along the left border of the sternum even as low as the ensiform cartilage. It is transmitted over a wider area than any of the other cardiac murmurs, being usually conducted down the sternum or even as far toward the left as the axilla. It is not carried with any great degree of distinctness upward in the direction of the cervical vessels. In quality it is loud, prolonged and blowing and while not harsh, possesses more of this element than does the murmur of aortic obstruction. The so-called "Flint murmur" (see p. 579) may be co-existent.

Upon placing the stethoscope over the carotid arteries the second arterial sound is less distinct than under ordinary conditions and may be absent, and the murmur caused by the leakage of the blood through the incompetent aortic valve may be audible; a short rough murmur ventriculo-diastolic in time may be heard as well. Ventriculo-diastolic and ventriculo-systolic murmurs may also be heard over the large peripheral arteries, especially the femoral and popliteal.

The pulse of aortic insufficiency is characteristic; its rise is quick and to an unusual height and it falls even more abruptly, as the blood flows back through the imperfectly closed valve from the aorta into the left ventricle. Its force is good and its rhythm regular except in disordered compensation. This

pulse is known as the "Corrigan," "water-hammer" or "shot" pulse and may be often detected by the eye above the bend of the elbow when the patient's hand is elevated. The throbbing of the carotid arteries is often visible and the impulse of the abdominal aorta may cause an epigastric pulsation. Retinal pulsation may be detected by means of the ophthalmoscope and a capillary pulse may be observed under the finger nails and by drawing a line across the forehead or cheek upon either side of which the skin flushes and pales with cardiac systole and diastole.

Patients with uncomplicated aortic insufficiency may maintain good compensation for long periods and even perform moderately hard labor, but when there are associated valvular lesions, arterial or myocardial disease, disturbance of compensation soon occurs.

Aortic Obstruction.

True and uncomplicated stenosis of the aortic valve is one of the rarest of valvular defects but roughening of the segments, with or without obstruction to the flow of the blood current, is less infrequent. With mere roughening of the aortic lining beyond the valve there is commonly a murmur present which differs only slightly if at all from that of true aortic stenosis. In pure stenosis of moderate degree the valve cusps are adherent and so stiffened that during the systole of the ventricle they do not fall back against the wall of the aorta but obstruct the emerging blood current to a greater or less extent; in advanced grades of the lesion the segments are thickened and hardened and may be converted into calcareous masses. The obstruction prevents the flow of blood into the aorta and in consequence left ventricular hypertrophy ensues which compensates for the stoppage. Until compensation becomes disturbed the rest of the heart remains in its normal condition but when failure takes place, dilatation ensues with consequent pulmonary congestion and hypertrophy of the right heart.

A relative aortic obstruction may result, when the valves remain normal but there is dilatation of the first part of the aorta.

Ætiology. Aortic obstruction is most frequently met in patients of advanced years and is usually associated with calcareous degeneration of the arteries.

Symptoms. While compensation persists the symptoms are insignificant but there may be vertigo and syncopal attacks due to insufficient cerebral and cardiac blood supply. Pain and symptoms of angina may be induced by exertion but are less common than in aortic insufficiency. Failure of compensation is followed by the usual symptoms of venous congestion, dyspnœa, cough, palpitation and œdema.

Physical Signs. Inspection reveals an apex beat displaced to the left, the degree of the displacement depending upon the amount of ventricular

hypertrophy; the apical impulse may be of good force if compensation is present; when the latter is disturbed and even before this event, it may be weak and indistinct.

Palpation confirms the signs detected by inspection; a thrill may be present at the base and apex, rarely at the apex only, and in certain instances of extreme hypertrophy there may be a prominence of the precordium. *Percussion* shows an increase of precordial dulness, especially downward and to the left.

Upon *auscultation* a ventriculo-systolic murmur is detected, loudest over the second right interspace close to the sternum and sometimes accompanied by a thrill. The *bruit* is harsh when there is roughening of the aortic lining; after disturbance of compensation it may become soft and more musical. The murmur is transmitted upward along the course of the blood current and may be audible in the popliteal and dorsal arteries of the feet. There may be a co-existent ventriculo-diastolic murmur due to associated aortic insufficiency; the double murmur of these lesions when occurring together may be mistaken for the *bruit* of aortic aneurysm (see p. 614).

The pulse is usually small, its upward stroke is tardy, and its rate may be slow but is more often frequent; it is regular while compensation persists.

The diagnosis of aortic obstruction is often difficult on account of the great similarity between its murmur and that of simple aortic roughening; with the latter condition the pulse is less small and no thrill is present. Functional murmurs which are so often heard at the base are more common in young persons, are associated with anæmia, are not accompanied by a thrill nor by any cardiac hypertrophy and are frequently intermittent.

Tricuspid Insufficiency.

Primary insufficiency of the tricuspid valve is very rare but may occur as a congenital defect; in certain instances it is observed as a result of acute or chronic endocarditis; secondarily the lesion takes place as a result of valvular affections in the left heart and is of the relative type. It is also met as a complication of conditions which cause pulmonary congestion, such as chronic bronchitis, pulmonary emphysema and fibroid phthisis.

Symptoms. These have been discussed at length in the section devoted to mitral insufficiency and are those of obstruction to the pulmonary circulation with congestion of the stomach, kidneys and liver, with enlargement and tenderness of the last organ, and anasarca. Late manifestations are cyanosis, dyspnœa and pulmonary œdema.

Physical Signs. Inspection reveals a diffuse pulsation in the region of the xiphoid cartilage and a pulsation of the liver and of the jugular veins. The latter is ventriculo-systolic in time and more forcible in the vessel of the right side. Upon coughing the vein may form a tumor-like protrusion; in some

subjects the pulsation may be observed in the subclavian, axillary and even in the cutaneous veins over the shoulder and breast. The hepatic pulsation is also ventriculo-systolic, the impulse resulting from the tricuspid incompetence being transmitted through the inferior cava to the veins of the liver.

Palpation confirms the signs detected by inspection. *Percussion* determines an area of cardiac dulness enlarged to the right margin of the sternum, the result of right ventricular hypertrophy.

Auscultation reveals a ventriculo-systolic murmur, the maximum intensity of which is over the sternum just above the ensiform cartilage. In quality it is soft and usually faint; it may be transmitted to the right as far as the anterior axillary line. It is often quite definitely localized to the tricuspid area. The pulmonic second sound may be accentuated. The relative tricuspid insufficiency occurring with mitral insufficiency may not be evidenced by a murmur; here the valve may be in perfectly normal condition, and the incompetency is the result of a dilatation of the valvular ring.

The diagnosis is simple when pulsation is present in the cervical veins and in the liver, these being pathognomonic signs. In many instances of relative tricuspid insufficiency where the lesion is secondary to mitral disorder, no murmur is present and the complicating affection may remain undiagnosticated until after death. In the differentiation of the tricuspid ventriculo-systolic *souffle* from that of mitral insufficiency the difference in location, quality and transmission are points to be remembered.

Tricuspid Obstruction.

Isolated tricuspid obstruction is a very rare condition but as a secondary lesion to disease of the left heart, especially mitral obstruction, it is not infrequently observed; it also occurs as a congenital defect together with other valvular affections. It seems to be more common in women than in men. The changes in the valve are analogous to those taking place as a result of like causes in other valves and the symptoms also resemble those due to similar lesions occurring in other parts of the heart. In advanced instances the more typical manifestations are cyanosis of the face and intense and persistent œdema.

Physical Signs. Enlargement of the right side of the heart is evident upon percussion, dulness being perceptible as far as the right margin of the sternum. A murmur beginning at the closure of the aortic valves, covering ventricular diastole and auricular systole, harsh in quality, accompanied by a thrill and ceasing abruptly with the impact of the apex against the thoracic wall, is an evidence of extreme tricuspid obstruction. This is a *bruit* practically identical with that of mitral obstruction, but the latter is heard over the apex. The two lesions are often co-existent and the signs of the latter may so obscure

those of the former as to render very difficult the diagnosis of the secondary condition. In many subjects a tricuspid obstruction may exist without giving definite signs.

Pulmonic Insufficiency.

This is a rare condition but may occur as a congenital lesion and it has been observed in malignant endocarditis.

The symptoms are those of venous congestion.

Physical Signs. There is increase to the right in the area of cardiac dulness due to hypertrophy of the right ventricle and in the later stages there may be pulsation in the veins of the neck. The characteristic murmur is ventriculo-diastolic in time, heard with maximum intensity over the pulmonic area—the second left space close to the sternum. It is to be differentiated from the *bruit* of aortic insufficiency by the absence of the characteristic pulse of this lesion and the lack of left ventricular hypertrophy. Very high pressure in the pulmonary artery may cause slight regurgitation through the valve and a consequent soft ventriculo-diastolic murmur.

Pulmonic Obstruction.

This is a very rare lesion; when it does occur it usually exists as a result of congenital cardiac disease and may be associated with anomaly of the tricuspid valve and of the inter-ventricular septum and patency of the ductus arteriosus or foramen ovale. Malignant valvulitis has been known to involve the pulmonic valve. When the defect is congenital the insufficiency is due to a union of the margins of the cusps.

The chief symptoms of pulmonic obstruction are those due to venous obstruction, particularly cyanosis and dyspnœa. It is one of the lesions which may cause the blueness of the so-called "blue baby."

Physical Signs. These are often indefinite; there is right ventricular hypertrophy with consequent increase in the area of cardiac dulness toward the right border of the sternum. The typical murmur occurs with ventricular systole and is heard loudest over the second left space close to the sternum; a thrill may be present. The pulmonic second sound may be faint or inaudible. At times the murmur is heard posteriorly between the shoulders.

The frequency with which murmurs are audible at the pulmonic area is remarkable but the clinician should be very chary of attributing these, in the majority of instances, to defects of the pulmonic valve which are extremely rare. Anæmic murmurs are often heard in this region as also are the functional *bruits* which occur when the heart is beating with undue force as during febrile disease or after unusual muscular exercise. In healthy individuals a

murmur may be heard, particularly if the thoracic wall is thin, over the base of the heart and the cardio-respiratory *souffle* may be noted in this vicinity. None of the above conditions is accompanied by other evidences of cardiac disease and the associated murmur should never be mistaken for that which evidences a defect of the pulmonic valve.

The murmur of mitral insufficiency may be heard as far up the left border of the sternum as the second cartilage but the differentiation of this lesion from those of the pulmonic valve should be made with ease (see p. 577).

Combined Valvular Lesions.

It is not at all infrequent to find associated lesions of two or more valves; the mitral and aortic valves are very often jointly affected as are the mitral and tricuspid. Aortic defects more commonly exist independently than those of the mitral valve but disease of the aortic valve is less likely to be accompanied by mitral stenosis than by insufficiency. In children a frequent combination is insufficiency of both the aortic and the mitral valve. A stenosis occurring with an aortic or mitral insufficiency may be beneficial in that it prevents too free regurgitation of the blood current.

Congenital Cardiac Defects.

These most frequently affect the right side of the heart and may be the result of inflammations occurring during intra-uterine life or of anomalies of development. In most instances they are incompatible with the continuance of life or if not, little can be accomplished by curative or palliative measures. Pulmonic obstruction is the most frequent lesion and other lesions which may be observed are persistence of the foramen ovale, of the ductus Botali, a patulous inter-ventricular septum and a persistent communication between the aorta and the vena cava or between the aorta and the right auricle. The exact diagnosis of the lesion in a given case is difficult since the murmurs present are not characteristic but the symptoms of congenital heart disease are typical. The most salient of these are insufficient physical development, persistent cyanosis (the "blue baby"), dyspnœa and clubbing of the fingers. The murmur is usually basic.

Various malformations of the heart have been described, such as entire absence of the organ—*acardia; double heart; dextrocardia*, in which the heart is in the right side of the thorax and with which transposition of the other viscera may or may not co-exist; and *ectopia cordis* where the organ may be located in the neck, thorax or abdomen. Fission of the thoracic wall and of the abdomen is associated with the last named condition. The semilunar valves may be two in number instead of three owing to a union of two

of the cusps (the bicuspid condition), and the semilunar cusps may be fenestrated.

The Prognosis in Chronic Valvular Lesions.

The outcome of any instance of chronic valvular endocarditis is difficult of prophecy since the factors which may influence it are numerous and uncertain. The problem depends wholly upon how long compensation can be maintained. Women seem to withstand the effects of valvular defects better than men, possibly because their habits and mode of life are more quiet and because the aortic valve is less frequently affected. Child-bearing is frequently fraught with no ill-effects. In children the prognosis is bad, the subjects of congenital heart disease seldom surviving more than a few years, while in those below the age of ten or twelve valvular lesions are serious even though the coronary circulation and the myocardium are likely to be in good condition. Much depends upon the maintenance of proper nutrition and the abstinence from violent exercise. Children affected with chronic endocarditis seldom die suddenly.

With regard to the prognosis of the lesions of the different valves it may be said that mitral defects are, other things being equal, less serious than those of the aortic valve, especially insufficiency, in which sudden death often takes place. The co-existence of a certain amount of obstruction with a valvular insufficiency is conservative, the stenosis preventing the regurgitation in some degree. In giving the prognosis in any valvular lesion we must take into consideration the condition of the heart muscle and of the arterial system and the general health and mode of life of the patient, as well as the amount of compensation present and the predisposition to rheumatism.

Intercurrent disease of even mild type is a serious matter to the patient whose cardiac valves are affected; especially is any pulmonary trouble likely to result unfavorably.

The Treatment of Valvular Lesions.

Prevention consists in the proper treatment of all diseases which are likely to be followed by cardiac defects, especially rheumatism and chorea. All rheumatic patients should receive prolonged salicylate treatment, for whether or not this class of drug influences the incidence of heart lesions, it certainly shortens the attack of rheumatism and in connection with prolonged rest renders relapse more unlikely. Subjects predisposed to rheumatism should be advised to avoid all exposure and every influence which may induce an attack.

1. *Treatment during the stage of compensation.* At this time the object should be to maintain the strength of the heart and to preserve the compen-

satory condition as long as possible. This is to be accomplished by properly managing the patient's mode of life. Cardiac tonics are not indicated and are harmful. Fortunately we are getting beyond the time when the detection of a cardiac murmur was a signal for a prescription containing digitalis. At present when the physician elicits the physical signs which lead him to make the diagnosis of a chronic valvular defect he must decide whether or not to tell the patient of his infirmity. The decision should be in the affirmative if the patient is of calm and steady mind and is leading a life prejudicial to the continuance of the compensated condition of his heart. If the subject in hand is hysterical and his habits are such as are not damaging to the cardiac condition it is better to let him continue in a state of blissful ignorance; a member of the family or a near friend, however, should be informed that heart disease is present. In certain instances, even in this latter type of patient, when the habits of life must be regulated, it may become necessary to appraise the individual of his condition even at the risk of rendering him hypochondriacal.

With regard to *exercise* during the stage of compensation no fixed rules can be laid down but it may be stated in general that exercise which is not followed by palpitation, dyspnœa and cardiac distress may be allowed, and even may prove beneficial. The more violent forms of exercise should be forbidden in mitral obstruction, but golf, slow bicycle riding, rowing in moderation, bowling, etc., are allowable, while tennis, boxing, fencing, wrestling, running and the like should be tabooed. In young persons affected with aortic insufficiency, the more strenuous varieties of exercise may be undertaken, but only when the heart muscle is unaffected and the arterial system is in good condition.

The *occupations* suitable for patients possessing valvular defects are of necessity limited to those of sedentary type such as desk-work of the various kinds, tailoring, shoe and harness making and the like. Aortic affections when well compensated need not preclude the carpenter and machinist, when heavy lifting is avoided, from continuing their avocations and out-door work of light character may prove rather beneficial than otherwise. Professional life such as that of the architect, designing engineer, newspaper worker, etc., may be continued but the public speaking demanded in certain kinds of law practice and of the clergyman is likely to put too great a strain upon the weakened heart, as is the general practice of medicine; an office or consultation practice, however, may be continued by the physician who is unfortunate enough to possess a valvular lesion. Vocations which entail severe nervous strain are quite as harmful as those which tax the muscular system.

Concerning *habits* it may be said that the use of alcohol is in most instances harmful but there are patients whose custom it has been to take a moderate amount of wine or beer with meals and in whom the appetite and digestion

suffer if these are discontinued; to such we may allow the milder alcoholic beverages in moderation, diminishing the amount as much as possible. Tobacco in moderation may be indulged in if absolutely necessary to the patient's comfort, but it is better if he can be persuaded to give it up entirely. Smoking certainly can produce no benefit and may be productive of harm. With regard to the mode of employment of the tobacco there is little to be said; it is the amount of the drug which is taken which should be regulated. It makes little difference whether the same quantity of tobacco is consumed in the form of the cigar, the cigarette or in the pipe. Inhalation of the smoke is especially harmful. Smoking, of course, should be forbidden if it appears to injure the patient.

While excessive indulgence in the sexual act is distinctly prejudicial, married life and even the bearing of children need not, in many instances, be advised against. Many women have passed through uneventful pregnancies and labors whose heart valves have been far from normal. In general we may state that while pregnancy is a grave consideration in compensated valvular disease it is by no means always dangerous. Labor is, however, fraught with peril, particularly when mitral lesions exist, and, for its safe consummation, depends upon the character of the compensation. The physician is justified in advising the artificial emptying of the uterus when danger of disturbance of the compensation is imminent or this event has already taken place.

The clothing should be of weight adapted to the season of the year and sufficiently warm to prevent chilling of the body. Woolen underclothing is always to be advised and particular attention should be given to the extremities which should never be allowed to become cold or wet. Tight garments, especially the corset when laced so snugly as to constrict the waist to the slightest degree, are harmful, and women should, if possible, be persuaded to wear their skirts suspended from the shoulders.

The patient's food should be properly cooked, easy of digestion and of sufficient, but not too great quantity. Much liberty may be allowed in choosing the dietary but regularity of meal times is important. With regard to the different classes of foods it may be said that patients who engage in active muscular exercise need more proteids than those who lead more sedentary lives and that anæmic subjects should be fed liberally upon those articles from which the organism may obtain iron.

Bathing should not be indulged in to too great an extent and should be regulated in accordance with the reaction obtained. Hot tub baths often have a weakening effect and for them daily sponging off of the body, with a tepid tub once or twice a week, should be substituted. If the cool bath followed by a brisk rubbing with a coarse towel is not followed by a healthy glow of the skin and a sensation of stimulation it should not be allowed. Sea and fresh water bathing influence the patient's condition both because of the shock

caused by entering the usually cool water and through the exertion necessary in swimming. These factors put a considerable strain on the heart and often one which the organ is ill able to sustain, consequently this form of bathing should hardly be indulged in by those with mitral defects and by others only in the greatest moderation. The baths provided by the various hydropathic institutions should be taken only upon the advice of a physician who can watch the effect upon the patient in hand.

All intercurrent illness should be promptly treated, particularly if the lungs are involved and in the case of the acute infectious diseases, and any systemic disorder such as anæmia, should be corrected. The digestive system needs attention in many instances and constipation is an especially important consideration.

Patients who are accustomed to living at a high altitude may be able to maintain life with comfort at such a level even after the incidence of a cardiac lesion and it is probable that heart patients can endure considerable elevation (6,000 feet or perhaps more) if they remain at rest when first coming to such an altitude and, having become inured to the change, abstain from exercise; yet it is hardly legitimate to advise the subjects of valvular defects to exchange a low altitude for a high one unless the circumstances render it necessary.

The precordial distress that is often complained of even while compensation is good, together with the dizziness and palpitation which so often accompany this symptom, may be relieved by a few days in bed and the administration of small doses of strychnine or of 10 to 20 drops (0.66 to 1.33) of the fluidextract of cactus taken three times a day. If there is tendency to vascular spasm or arterial hypertension this may be combated by glyceryl nitrate (nitroglycerin) in doses of $\frac{1}{100}$ of a grain (0.0006) three or four times a day.

2. *The treatment of disturbed compensation.* The earlier symptoms of this stage are dyspnœa upon exertion or coming on during the night, loss of flesh and anæmia; later the signs of cardiac dilatation are noted, the heart's action becomes irregular, venous congestion is evident and œdema may appear. Upon the onset of these symptoms *absolute rest in bed* should be insisted upon and it is surprising, in many instances, to observe the effects of this simple procedure when instituted in connection with the carefully regulated diet and thorough clearing of the bowels. If the patient is unable to breathe comfortably while in the recumbent position he may be propped up by pillows or by the back rest which is in common use in hospitals.

With regard to drugs we have three factors upon which to base our treatment. These are: *first* and most important: The condition of the arterial system. The consideration of this should dominate our entire management of the patient and determines the result which we are able to accomplish. *Second:* The condition of the muscular wall of the heart. *Third* and least to be considered: The valvular lesion itself.

Probably no drug has enjoyed a greater vogue in the treatment of valvular heart disease than digitalis although its field of usefulness is limited. Its advantages are that by slowing the pulse rate it gives the heart opportunity to rest and improves the nutrition of the walls of the heart by its stimulating influence upon the pneumogastric nerve, as well as by increasing the blood supply of the cardiac muscle by rendering the systole more complete and prolonging the diastole. By its action the pressure in the coronary arteries is increased and more time is allowed for their filling. It may produce permanent benefit by reason of the assistance which it affords in the production of compensatory hypertrophy. The constriction of the peripheral vessels caused by it is an objection to its use but this may not be sufficient to seriously interfere with the increased cardiac power secured, and even if this is the case, this effect may be counteracted by drugs which have an opposite action, such as the nitrites; the exhibition of these will also lessen the tendency to the exertion of the so-called cumulative effect of digitalis. The particular indications for the administration of this drug are a rapidly and irregularly acting heart, low tension pulse and the presence of venous congestion. In *mitral regurgitation* as regards the employment of digitalis we may divide the condition into three groups: 1. Those in which the left ventricle is but little enlarged, while the nutrition of its muscular wall is well preserved, and which may be attended by no inconvenience other than dyspnœa (often slight) upon exertion. 2. Those with œdema of greater or less extent. 3. Those in which, with extensive dilatation, there is little or no œdema but well-marked pulmonary congestion. By increasing the force of the contraction of the left ventricle an approximation of the mitral cusps is caused which reduces the amount of the regurgitation and diminishes the venous congestion. Under the action of the drug the increased force of the systole will throw proportionately more blood through the aortic orifice than through the partly open and obstructed mitral valve, and the large orifice eventually gaining on the smaller, more blood will pass into the general circulation and the pulmonic vessels will be relieved. The lengthened diastole will also be of service in allowing more time for the blood to flow into the left ventricle. Thus both auricles and ventricles gain increased power to empty themselves and the longer intervals between pulsations enable the former to more completely discharge their contents into the ventricles. The general improvement in the circulation caused by the drug has an excellent effect in relieving the cardiac pain and distress and the dyspnœa and cyanosis, and the more dropsy characterizes the condition the more efficient will the drug prove.

One of the most prompt results of its administration is a marked increase in the quantity of urine, hence it is of essential service in relieving cardiac dropsy; here it not only regulates the circulation and causes evacuation of the surplus fluid through the kidneys, but also acts directly on the vessels by

increasing vaso-motor force. In some instances the diuretic effect of digitalis is materially assisted by its combination with an alkaline diuretic such as potassium bitartrate or citrate and occasionally it may be found that diuresis can be established only after free purgation. When sleeplessness is a marked symptom it is due to the non-maintenance of the relationship between the cerebral vessels and the general circulation—by restoring this balance digitalis enables the patient to sleep. Dyspnœa is relieved by the action of the drug in establishing a more efficient pulmonary circulation. By improving the venous flow toward the heart it will be of service in counteracting the venous engorgement and œdema of the lungs, the right heart, the liver, the kidneys, and the subcutaneous tissues, so frequently observed.

In some patients with mitral regurgitation digitalis may seem to be indicated and yet prove injurious rather than beneficial; this may be due, in part at least, to its causing too great a strain upon the auricle, since with a very patulous mitral valve the blood is readily backed upon the auricle, and this, being already too weak for the ventricle, is unable to withstand the strain imposed upon it by the stimulated ventricle. Conversely to the previously made statement, the less closely a case of mitral regurgitation approaches the œdematous type, the less the benefit which is likely to be derived from digitalis in it.

In most instances of *mitral obstruction* the same benefit will accrue from the administration of digitalis as in mitral regurgitation, the increased resistance here leads to the same general results as in the leakage of mitral insufficiency and like the latter these can be successfully combated by the strengthening effect of the drug upon the heart-beat. The resulting lengthening of the diastole will allow more time for the auricle, the contracting power of which is at the same time increased, to empty itself into the ventricle through the obstructed orifice. The ventricle thus more perfectly filled sends more blood into the systemic circulation and the circulation is further improved by the stimulation of the right ventricle induced by the digitalis which affords it greater power to force the blood through the lungs. It is possible, however, that the increased work of the right ventricle, combined with the mitral obstruction, may produce pulmonary congestion with the result of lessening the oxygenation of the blood and so interfering with the nutrition of the heart, so that in well-selected cases the beneficial effects of digitalis exceed in great measure any possible evil ones. The general amelioration of symptoms which the drug will bring about is much the same as in the case of mitral insufficiency.

In diseases of the *aortic valve* there is a diversity of opinion concerning the advisability of giving digitalis. While certain observers assert that its advantages more than offset its disadvantages, there is but little question that the drug is better omitted in instances of aortic insufficiency. It increases

the work of the heart and the prolonged diastole which it causes favors the return of blood through the imperfectly closed orifice and exposes the ventricular wall to excessive strain so that there is danger of syncope. In aortic obstruction, before the incidence of compensatory hypertrophy, it may prove of service. There is some obstruction to the outflow of blood from the heart and digitalis will increase the ventricular force so that it may overcome the difficulty. After compensatory hypertrophy has become established the drug is useless and its administration may result fatally; but when aortic obstruction leads to mitral insufficiency it may be given with advantage. Likewise in aortic insufficiency, when complicated by relative mitral insufficiency, when there is considerable dilatation of the left ventricle, perhaps of sudden onset and associated with dyspnœa, precordial pain and anxiety, the drug may be given with beneficial results. While digitalis is usually contraindicated in aortic insufficiency especially when associated with aortic obstruction, yet when the heart muscle fails and the hypertrophy is not compensatory it is useful, but here, as well as in all cases of aortic disease, its effects must be very carefully watched.

The indication for giving or withholding digitalis in valvular disease rests far less upon the particular lesion present than upon the results of this defect upon the cardiac wall. A knowledge of the relation of the heart muscle to the work required of it in any individual instance is, therefore, much more important from a therapeutic standpoint, than the recognition of a pathological condition of the valves. It may be stated in general terms that digitalis is of special value in all conditions in which dilatation of the heart cavities has resulted in valvular disease from failure of the muscular wall.

In *tricuspid lesions*, both obstruction and insufficiency, digitalis is useful in the same manner as in mitral disease and particularly so in insufficiency associated with dilatation of the right ventricle; as a rule, however, the beneficial results are less marked than in mitral defects and as in the latter the rational signs usually furnish clearer indications for the employment of the drug than do the physical. Thus, it is indicated when the pulse is rapid and feeble and the pulse tension low, and when cough, dyspnœa, pulsation of the jugular veins, cyanosis, scanty urine and anasarca are present.

Constriction of the peripheral vessels, which is one of the chief physiological effects of digitalis, is often so marked as to interfere materially with the successful use of the drug in cardiac disease. Here it should be given in association with remedies which cause dilatation of the vessels, such as the nitrites; of these glyceryl nitrate enjoys the greatest vogue but as its effects last but a short time in comparison with those of digitalis it should be given more frequently, usually six to eight times daily; its dosage should be measured by the effect obtained but is generally from $\frac{1}{100}$ to $\frac{1}{50}$ of a grain (0.0006 to 0.0012). Sodium nitrite—dose 5 grains (0.33)—may also be employed

but it is difficult to obtain in a pure state, being usually contaminated with the nitrates. Better than either is erythrol tetranitrate; this drug is less used than its merits deserve and there is little question that for constant employment it is superior to the more evanescent glyceryl nitrate and the somewhat uncertain sodium nitrite. Its dose is from $\frac{1}{10}$ to $\frac{1}{2}$ a grain (0.006 to 0.032) and in compounding it its explosive properties should be remembered. It is best administered in pill form with kaolin as an excipient. To return to digitalis, since it acts very slowly and maintains its effect for a long time, it is often sufficient, after the primary effects have been obtained, to administer it but once a day, for the purpose of continuing its influence.

With regard to the value of the different preparations of the drug those most used are the tincture—dose 15 drops (1.0)—and the infusion—dose 2 drachms (8.0); the latter being particularly indicated when a diuretic effect is desired and it is said to be less disturbing to the stomach than the tincture or the fluidextract which last enjoys considerable vogue among certain therapeutists; its usual dose is 1 minim (0.065). When it is desirable to give the drug hypodermatically digitalin $\frac{1}{64}$ to $\frac{1}{32}$ of a grain (0.001 to 0.002) may be employed.

Of the drugs which may be substituted for digitalis strophanthus deserves first mention. It possesses several advantages over the former, namely: (1) greater rapidity of action, modifying the pulse rate within an hour; (2) less marked vaso-constrictor effect; (3) greater diuretic powers; (4) no digestive disturbance from properly made preparations; (5) absence of cumulative effect; (6) greater value in children, whose vasodilators are easily affected; and (7) greater safety in the aged in whom the vaso-constriction is often present primarily. The especial indications for the employment of strophanthus are: 1. Rapidly recurring cardiac systoles of lessened force and irregular rhythm. Here we get, first, a more vigorous ventricular contraction with slowing of the pulse rate and a consequent lengthening of the diastole, which is the period of rest for the heart, next the irregularity disappears, and lastly, from improved nutrition of the heart we obtain a permanent strengthening of its muscle. 2. The comparative insignificance of the vaso-motor effects permits the use of the drug in those instances of permanent high tension which are met in some forms of nephritis and in the rigid arteries of the aged. 3. Whenever diuresis can be promoted by increased blood tension resulting from more vigorous cardiac contractions this may be expected from the employment of strophanthus. 4. The rapidly appearing effects of its administration, together with its regular elimination, make it the drug of choice when the symptoms are urgent. 5. The absence of digestive disturbances from therapeutic doses and slight likelihood of habituation make it important when long-continued use is necessary. It should, therefore, be the remedy of choice in all patients, (1) in whom we wish to establish compensation; (2)

of arterial degeneration when more energetic cardiac contraction is required; (3) of cardiac disease when a diuretic is necessary; (4) of weak or irritable heart action; (5) of cardiac disease in childhood or old age. Failure will follow its administration in: (1) advanced degeneration of the heart muscle; (2) extreme mechanical obstruction to the circulation from valvular insufficiency or obstruction; and (3) a combination of these. The drug should not be employed in too large or too frequently repeated doses; usually a dose of 5 minims (0.33) of a reliable tincture three or, possibly, four times a day is sufficient. Given with erythrol tetranitrate it affords absolute control of the blood-vessels.

Erythrophloeum may also be employed as a substitute for digitalis. Its effects are practically the same but it is rather less reliable. Its employment should be confined to instances of a fairly competent heart with low arterial tension and to those cases in which digitalis has lost its usefulness or has utterly failed. The dose of the tincture is from 5 to 10 minims (0.33 to 0.66).

Caffeine is chiefly useful in heart affections in cases attended with dropsy where by its marked diuretic action it is often very efficacious; it may often be combined with digitalis, strophanthus and other heart tonics. When given for considerable periods it may produce insomnia or even marked hallucinations similar to those of delirium tremens; its usual dose is from 1 to 3 grains (0.065 to 0.2), or it may be administered hypodermatically, when a rapid effect is desired, as caffeine sodio-benzoate, of which the dose is 2 to 10 grains (0.13 to 0.66).

Strychnine is a reliable cardiac stimulant in instances of valvular disease where digitalis is contraindicated and may be often combined to advantage with other heart tonics, such as caffeine. When there is imminent danger of failure of the heart's action, and especially in pulmonary œdema, this drug administered hypodermatically in large and frequently repeated doses very often is of the greatest service. Here as much as $\frac{1}{20}$ (0.003) or even $\frac{1}{10}$ of a grain (0.006) may be given and repeated if necessary, but as soon as muscular twitchings are noticed it must be discontinued.

Sparteine sulphate may be employed, especially when diuresis is desired; its dose is $\frac{1}{5}$ to $\frac{1}{2}$ a grain (0.012 to 0.033) and it is also said to be valuable in producing regularity of the heart action. It quickens the beat when a weak, atonic state is present and is quick in action. On the whole it is inferior to digitalis, but is not cumulative and is useful, especially in uncompensated mitral disease.

Other cardiac stimulants that may be mentioned are adonidin, convalleria and cactus grandiflorus. The first of these possesses the same indications as digitalis; it is, however, less serviceable but may prove a satisfactory substitute when the latter drug is contraindicated or fails. Its action is prompt and it is often valuable in beginning the regulation of the cardiac movements

before digitalis has had time to take effect. Its dose is $\frac{1}{6}$ to $\frac{1}{3}$ of a grain (0.01 to 0.02); it is too irritating to be employed hypodermatically. Convalleria is unreliable in its effect and its vaunted selective action upon the right heart is probably fictitious. Its indications are the same as those for digitalis. The dose of the fluidextract is 8 minims (0.5). Cactus is of great use in aortic insufficiency but is absolutely contraindicated in mitral obstruction, thus being of value only where digitalis is inadmissible. It increases both the cardiac force and rapidity, being, perhaps, the only drug which possesses this effect. It does not replace other cardiac stimulants but is useful in many instances where these are dangerous. Cactus is active only when carefully prepared from the green plant. A properly made fluidextract is of a peculiar opalescent-green color; if brown it is inert. The dose is from 10 to 30 minims (0.66 to 2.0).

In addition to the administration of drugs there are other measures by which the impeded circulation may be relieved. Of these venesection is one of the most effectual and is particularly indicated in mitral obstruction with pulmonary congestion, marked dyspnœa and cyanosis and in dilatation with arteriosclerosis. As many as 20 or 30 ounces (600.0 to 900.0) of blood may be withdrawn. Depletion through the bowels is another useful method of relieving venous congestion and may be well carried out by the method of Matthew Hay which consists of the administration in the evening of 2 ounces (60.0) of magnesium sulphate which have previously been dissolved in an equal amount of boiling water. The patient should take nothing to drink before the noon of the following day and usually before this time he will have had several watery stools and will have noticed a marked increase in the quantity of urine. The exhibition of so drastic a cathartic as the above is not contraindicated even if the pulse is feeble and irregular.

The Schott method of treatment by means of carbonic acid gas baths and resistance exercises is useful in all forms of loss of compensation. For a description of these measures the reader is referred to p. 561.

The anæmia which is so frequent an accompaniment of cardiac disease necessitates the routine administration of iron and other tonics, especially strychnine.

The Treatment of Special Symptoms: Dyspnœa. This symptom is due to insufficient oxygenation of the blood in the lungs as a result of the congestion of these organs; the correction of the pulmonary engorgement by means of the remedies suggested above will often relieve the shortness of breath; if the congestion has resulted in the transfusion of serum into the pleural cavities these should be aspirated and the fluid withdrawn. Re-accumulations necessitate repetition of the operation. Dyspnœa, when due to arterial contraction, may be lessened by the vaso-dilators as suggested above. In the marked nocturnal dyspnœa of advanced cardiac disease often nothing but morphine will afford relief although the compound spirit of æther—1

drachm (4.)—repeated if necessary, sulphonethylmethane (trional),—gr. x (0.66)—sulphonmethane (sulphonal),—gr. xx (1.33)—diethylmalomylurea (veronal)—gr. x (0.66), or chloralformamide (chloralamide)—gr. xxx (2.0), may be tried. These failing, morphine may be given without fear, for it has a distinctly cardiac stimulant effect, in dose of $\frac{1}{4}$ of a grain (0.016) either subcutaneously or by mouth. Inhalations of oxygen may give relief.

Palpitation and Precordial Distress. In addition to the heart stimulants discussed above we may employ locally the ice coil, a belladonna plaster, a closely watched nitric acid issue or other blister. The combination of potassium iodide or glyceryl nitrate and belladonna with digitalis is often effectual and when the heart is markedly over-active, turbulent and irregular, the tincture of aconite in doses of 5 or 10 minims (0.33 to 0.66) every hour often produces excellent results. This drug should be carefully watched and discontinued as soon as the condition is relieved or untoward effects are noted. Palpitation and oppression due to gastric and intestinal distention necessitate the exhibition of laxatives and intestinal antiseptics.

Œdema. In addition to the measures already described for relief of the general venous congestion, particularly the administration of digitalis, strophanthus and caffeine which are diuretics, and glyceryl nitrate and erythrol tetranitrate which increase the blood supply of the kidney by dilating the renal artery, together with depletion by means of hydrogogue cathartics, such as elaterin and jalap, and Hay's method, we have other means at our disposal. The increase in the action of the kidneys following the employment of copious high rectal irrigations of hot normal saline solution at 116° to 120° F. (46.5° to 49° C.) is often very marked and this simple procedure may be repeated several times daily if necessary. The Guy's diuretic pill consisting of 1 grain (0.065) each of powdered digitalis, squill and calomel, given every four or six hours for two or three doses and theobromine sodio-salicylate, 1 to 2 drachms (4.0 to 8.0) have been used with benefit. Œdema of the legs may be lessened by the recumbent position or by bandaging. In extreme instances scarification may become necessary; this should be done under the strictest antiseptic precautions as should abdominal paracentesis, which is indicated in marked degrees of ascites. The management of hydrothorax has already been considered. The treatment of dropsical conditions by means of decloridation will be discussed in the section upon renal diseases.

The insomnia which is frequently a source of great discomfort to the patient may be relieved in milder instances by a drachm (4.0) of the compound spirit of æther or a half drachm (2.0) of paraldehyde or of amylene hydrate taken on retiring. The great disadvantage of all these is their unpleasant taste and the fact that the two first produce disagreeable eructations. Sulphonmethane (sulphonal), sulphonethylmethane (trional) and veronal may prove useful and it may become necessary to place our dependence upon morphine.

With regard to *diet* no very fixed rules can be laid down. During the absence of compensation the regimen should be of the lightest and consist chiefly of milk, the meat broths and extracts and soft eggs. Carbohydrate foods should be given with caution on account of their proneness to cause flatulence. Should the stomach become disturbed and nausea and vomiting supervene these may be relieved by a greater restriction of the diet. Milk with lime water or vichy may be given; bits of cracked ice and small quantities of iced champagne are frequently useful. The addition of 10 grains (0.66) of cerium oxalate and 20 grains (1.33) of sodium bicarbonate to each glass of milk will sometimes relieve nausea. Upon the re-establishment of compensation a gradual return to a more generous diet, which may include fish, scraped beef, the white meat of poultry and other like articles, should be allowed.

The treatment of congenital heart disease differs in no essential from that of acquired cardiac defects; the measures discussed above should, however, be so regulated as to render them applicable to children.

THE NEUROSES OF THE HEART.

PALPITATION.

Definition. An abnormally rapid action of the heart, not associated with evidence of organic lesion, but of which the patient is conscious and which may be regular or irregular. Murmurs due to functional disorders may be present especially if anæmia is co-existent.

Ætiology. The condition is more common in the female sex and is very frequently observed at the incidence of puberty, at the menstrual epoch and at the menopause. All the causes contributing to the neurasthenic or the hysteric state may be named as ætiological factors, such as mental over-work and emotion, uterine and gastric disorders, anæmia and the physical weakness induced by over-work or long illness.

A frequent cause is the abuse of alcohol, tea, coffee, or tobacco. The so-called "irritable heart" described by Da Costa as occurring in the soldiers engaged in the Civil War was associated with neurotic palpitation but to its causation there were other contributory factors such as mental anxiety, physical over-work and weakness due to illness. With the palpitation in these patients dilatation was probably often associated.

Symptoms. Of these the consciousness of the heart's action is the most prominent. The discomfort may be merely an evanescent fluttering accompanied by merely slight discomfort, or the action of the organ may be greatly accelerated, irregular and markedly increased in force. This manifestation lasts varying periods of time, occurring often in paroxysms (*paroxysmal tachy-*

cardia) and may be associated with a sense of weakness or with nausea, flushing or paleness of the face and an increased urinary excretion. An attack may be induced by exertion.

Physical examination of the heart reveals little except the increased rate of its pulsations; the heart sounds may be sharp and distinct or impure; there may be accentuation of the pulmonic or aortic sounds. Ventriculo-systolic murmurs may be present, heard usually at the base but sometimes at the apex.

The diagnosis is based upon the intermittency of the attacks, the co-existent neurotic element or anæmia and the fact that the condition is met in young individuals as a rule.

The prognosis as to life is favorable, although the condition itself may present difficulties as to its removal.

TACHYCARDIA AND BRADYCARDIA.

Tachycardia or rapid heart may be a normal condition, individuals having been observed in whom the pulse-rate in perfect health was 100 or over. Paroxysmal tachycardia is a condition in which spasmodic increase in the pulse-rate takes place at intervals and without assignable cause. The paroxysms last from only a few moments to several hours and may occur at varying intervals. The cardiac pulsations may reach 200 to 220 per minute.

Bradycardia or slow heart also may be a normal condition, many persons having in health a pulse much lower than the normal 72; a rate of from 50 to 60 is not unusual and instances of much lower pulse have been reported. Care should be taken to make sure that the radial impulses correspond in number to the apical impulses, since it is not infrequent in certain cardiac conditions for the alternate systole to be too weak to send an impulse to the periphery. Slowness of the pulse may be observed during pregnancy and is a natural consequence of hunger and senility.

Bradycardia has been noted as a pathological entity in (a) convalescence after the acute infectious diseases; (b) dyspepsia, jaundice, gastric ulcer and cancer; (c) pulmonary diseases, rarely; (d) circulatory diseases, particularly those affecting the cardiac muscle and in connection with deficient supply of blood in the coronary circulation; (e) nephritis; (f) toxæmia from uræmia, lead, alcohol, coffee and digitalis; (g) constitutional diseases such as gout, anæmia and diabetes; (h) nervous diseases, apoplexy, neoplasms, affections of the medulla and cervical cord, epilepsy, general paralysis, etc.; (i) genito-urinary and cutaneous diseases.

Bradycardia is the result of irritation of the center of origin of the vagus or of its peripheral portion; it also may be caused by a condition of exhaustion of the cardio-motor apparatus.

The *Adams-Stokes syndrome* is a variety of bradycardia sometimes transient but usually permanent and associated with attacks of dizziness or even convulsions and unconsciousness. Dyspnœa and perhaps Cheyne-Stokes respiration are frequently associated symptoms. It is met with in old subjects with arteriosclerosis, in myocarditis of syphilitic origin and may occur as a neurosis. The pulse-rate may fall even to 20 or 10 per minute. In neurotic patients it is not a serious condition but in its other forms the prognosis is less favorable although death may not supervene for years. It is the result of affections of the pneumogastric nerves, of the medulla oblongata, and of disease of the inter-ventricular septum which causes a disordered action of the auriculo-ventricular bundle of His, a group of muscle fibres which has its origin in the inter-auricular septum below the foramen ovale and passes downward and anteriorly to the junction of the auricles with the ventricles, where it is in close approximation to the mesial cusp of the tricuspid valve, and finally ends just below the origin of the aorta.

Under the term *heart block* a condition has been described which is characterized by failure of the ventricle to follow each auricular contraction, in other words the auricular systole takes place more often than does the ventricular contraction. This peculiarity is believed to be due to an affection (*a*) of the ventricular wall, (*b*) of the pneumogastric nerve, or (*c*) of the connection between the auricle and ventricle.

ARRHYTHMIA.

Cardiac arrhythmia or irregular pulse may occur in various forms: (a) Irregularity in time in which an occasional beat is omitted; this omission may occur at irregular intervals or more rarely it may appear as a regular irregularity in which every second, fourth, sixth, etc., beat is lost. In other instances the so-called *pulsus bigeminus* or *trigeminus* may be observed in which two or three beats closely succeed one another to be followed after an interval by a repetition of the phenomenon. These often occur with mitral disease. (b) Irregularity in force; here the rate is regular but the strength of the pulsations is unequal and consequently an alteration in volume is frequently co-existent. (c) Irregularity of force and frequency may occur in combination.

Rarer varieties of cardiac arrhythmia are the *pulsus paradoxus* described by Küssmaul which is characterized by an increase of rate and a decrease in force during inspiration. It is observed in chronic pericardial adhesions, pleuro-pericardial adhesions, compression of the aorta and in weak heart action due to any cause; the *gallop rhythm* in which the sounds occur in threes and resemble in time the sounds made by the foot fall of a horse at a canter; this is met in the cardiac hypertrophy of arteriosclerosis and nephritis, in

certain forms of myocardial degeneration and extreme anæmia; *embryocardia* in which the first sound closely resembles the second, as in the fœtal heart. This occurs in extremes of dilatation and in the cardiac weakness of the later stages of the severer infectious diseases. *Delirium cordis* is the most extreme type of cardiac irregularity; both force and frequency are affected and the condition may be seen in extraordinary types of dilatation and of severe exophthalmic goitre.

Ætiology. Arrhythmia occurs as a result of (a) cerebral influences, both organic, as in hæmorrhage or concussion, and functional; (b) reflex disorders of the circulation caused by associated digestive, pulmonary and renal affections; (c) the influence of poisons such as tobacco, tea, coffee and various drugs; (d) cardiac changes which may affect either the innervation of the organ or its muscular structure.

Symptoms. Cardiac irregularity in many instances is accompanied by no symptoms and may be detected by accident. In other instances the patient may be conscious of the condition and annoyed by it even though it interferes in no way with his routine of life. In subjects in whom it occurs as a result of cardiac weakness or disease it is associated with the other manifestations of these conditions.

The diagnosis can be readily made by the careful routine methods of physical examination of the heart and pulse. When the condition is not organic this fact can be ascertained from the history and consideration of the symptoms and physical signs.

The prognosis is in many instances most favorable, functional irregularity not being prejudicial to health; the outlook is much more dubious when disease of the arteries or of the heart muscle is present.

The Treatment of Palpitation and Tachycardia.

The same means are applicable to both these conditions. Recognition of the cause is, of course, necessary, and this should receive appropriate treatment. When due to hysteria or neurasthenia the management of the cardiac condition is primarily that of the nervous condition; anæmia, digestive disorders, uterine affections, etc., should be corrected. Sexual excitement, tea, coffee and tobacco should be prohibited and a life free from worry and from physical over-exertion should be enjoined. In certain instances a course of treatment by means of carbonic acid gas baths and resistance exercises is very beneficial and the Weir Mitchell cure is strongly indicated in neurasthenic and hysteric patients when practicable. The application of the galvanic current to the vagus has been suggested; the positive pole should be placed under the angle of the mandible and the negative lower in the neck or

over the sternum. Only a weak current should be used and this but for a few minutes only. Electricity, it should not be forgotten, is often dangerous and a strong current may cause stoppage of the heart's action.

During the paroxysm the patient should be put completely at rest, preferably in bed, although, if dyspnœa is present, the shoulders may be elevated. Quiet should be enjoined and all disturbing influences should be avoided. The over-acting heart may be calmed by the application of the ice coil to the precordium and in connection with this, frequent drinking of cold water or holding of bits of ice in the mouth is recommended. At the beginning of an attack, as an abortive measure, we may rub in an ointment made as follows: ℞ veratrinæ, gr. iii (0.2); extracti opii, gr. xv (1.0); olei terebinthinæ, ♏i (0.065); olei menthæ piperitæ, ♏xv (1.0); adipis benzoinati, q.s. ad ℥i (30.0). Misce et signa external use. When the heart action is markedly rapid aconite or veratrum viride may be employed and in neurotic subjects the bromides and the antispasmodics are beneficial. The following formulæ may be found useful. ℞ camphoræ monobromatæ, gr. ii (0.13); zinci valeratis, gr. i (0.065); extracti hyoscyami, gr. ss (0.033). Fiat pilula numero i. Signa one pill every 4 hours. ℞ tincturæ veratri, ℥ss (15.0); aquæ destillatæ, syrupi aurantii, āā q.s. ad ℥iv (120.0). Misce et signa one teaspoonful three or four times a day. When precordial distress is marked it may be relieved by a mixture containing tincture of veratrum, ℥ss (15.0); Hoffmann's anodyne, ℥iss (45.0); codeine, gr. v (0.33); compound tincture of cardamom to ℥iv (120.0). If anæmia is present we may employ iron and arsenic. Digitalis should be given with discrimination and in obstinate instances of palpitation with weak, frequent and irregular pulse. In very severe cases the use of morphine in $\frac{1}{4}$ grain (0.016) doses may become necessary.

The Treatment of Bradycardia.

In managing this condition the primary cardiac affection, if detected, should receive appropriate treatment. Concurrent arteriosclerosis should also be given attention. Digitalis should not be employed in fatty heart but in obstinate instances of bradycardia, if the pulse rate is not below 50, small doses may be given with benefit in some instances. The patient's general condition should be attended to and proper diet and mode of life enjoined; the bowels should be kept open and all disturbances of digestion avoided in so far as possible. The attacks necessitate confinement to bed and the diffusible cardiac stimulants, alcohol, ammonia, etc., should be prescribed. Inhalations of amyl nitrite are suggested if there is tendency to arteriosclerosis and arterial contraction. Glyceryl nitrate (nitroglycerin) and strychnine are also useful and the administration of caffeine either by mouth or hypoder-

matically is recommended where the condition is due to lack of blood supply in the medulla. The following formula may be prescribed to advantage: ℞ caffeinæ sodio-benzoatis, gr. xx (1.33); sparteinæ sulphatis, gr. iii (0.2); aquæ destillatæ, syrupi aurantii, āā q.s. ad ℥iv (120.0). Misce et signa one teaspoonful (4.0) thrice daily. In the bradycardia of uræmia pilocarpine hydrochloride combined with alcohol is useful. The former when carefully watched, and its depressing effect counteracted by alcohol, may be given in divided doses up to 1 or 2 grains (0.065–0.13) daily.

The Adams-Stokes syndrome is very difficult of treatment. The patient's general condition should be cared for and the digestion should receive particular attention. The diffusible stimulants may prove of benefit but are often disappointing; the inhalation of oxygen for a time each day, the hypodermatic administration of morphine and the employment of digitalis have all acted well in certain instances but as a rule produce but indifferent results. The same is true of glyceryl nitrate. A patient reported by Stokes was able to abort or to lessen the severity of an attack by placing himself on his hands and knees and hanging his head as low as possible; supposedly relief was brought about by increasing the cerebral blood supply.

The Treatment of Arrhythmia.

The treatment of the disordered rhythm of chronic endocarditis is comprised in the treatment of the causative affection. The cerebral conditions which cause irregular heart action are difficult to influence but the instances due to renal, digestive and pulmonary abnormalities may be benefited by the proper management of the primary condition. The general treatment of cardiac arrhythmia consists in forbidding tobacco, tea, and coffee, regulating the diet and mode of life and if the symptom is associated with palpitation, tachycardia or bradycardia, the employment of the means suggested above for the amelioration of these affections.

ANGINA PECTORIS.

Synonym. Stenocardia.

Definition. A symptom of various lesions of the heart and blood-vessels characterized by paroxysms of severe pain referred to the heart and to the neck, shoulders and even down the arms. The attack is often accompanied by dyspnœa and in very marked instances by a sense of impending death.

Ætiology. The condition is confined almost exclusively to adult males, heredity seems to have a certain influence in its causation and gout, diabetes and influenza may be mentioned as predisposing factors. Anginal attacks

may occur in endocardial lesions, particularly those affecting the aortic valve, in adhesive pericarditis, syphilitic disease of the aorta, and during the development of aortic aneurysm.

As exciting causes of the paroxysm sudden mental or physical over-exertion, sudden exposure to cold and distention of the stomach by food or gas may be mentioned.

Various theories have been advanced to explain the occurrence of the attack and of these the most generally accepted is that it is the result of a temporary diminution of the blood supply of the cardiac muscle due to sudden contraction or to disease of the coronary arteries, or affections of the neighboring structures which interfere with the free passage of blood through them. Other explanations of the symptom are that it is due to a spasm of the vaso-motor nerves of the heart, to a spasm of the heart muscle, to neuralgia of the cardiac nerves, and that it is a functional neurosis.

Pathology. The most constant change found *post mortem* is an atheromatous condition of the coronary arteries and of the first part of the aorta; with these general arteriosclerosis and myocardial degeneration are frequently associated. By no means all instances of coronary arteriosclerosis are characterized by attacks of angina pectoris.

Symptoms. The paroxysm is characterized by the sudden onset, during unusual exertion or excitement, of an agonizing pain, usually referred to the middle or back of the sternum, (Beaumés's sign), but radiating to the arms, more often the left, or even to the abdomen or pelvis or down the leg. There is an accompanying sensation of constriction of the chest and dyspnœa. The facies expresses the agony which the patient is experiencing, it is pallid or ashy and may be moist with perspiration; there is great restlessness and anxiety. The heart action may be unaffected, accelerated or retarded, the pulse tension is usually increased. The sense of impending death is not always present. The attack may last but a few moments or may be prolonged to half an hour; as it passes off the patient is left in a state of weakness and he may belch a considerable quantity of gas and pass urine of light color and low specific gravity. Death may take place during the paroxysm or unconsciousness may supervene, from which the patient recovers.

The diagnosis in marked instances is not difficult but the milder forms, which are frequently observed, are likely to be difficult of separation from the so-called *reflex* or *pseudo-angina pectoris*. The latter may occur at any age and is more common in women of hysterical type and deteriorated condition, it is not associated with arteriosclerosis, the pain lasts longer and the patient is excited and agitated during the paroxysm, while the subject of a true anginal attack is quiet. The attacks of pseudo-angina are often periodical and may occur at night while the contrary is the case with true angina. In the false angina due to excessive use of tobacco, tea or coffee, there is a history

of the habit, the heart is rapid and irregular and arteriosclerosis is not a prominent feature.

The prognosis is grave; the patient may die in his first or in a subsequent paroxysm; sudden death may take place in the interval or there may be recurrent attacks for years until finally the fatal one takes place.

Treatment consists in the employment as a routine of means calculated to combat the sclerotic condition of the arteries (see p. 608). In syphilitic aortitis antiluetic medication is indicated. The patient should lead a quiet life and should avoid all excesses that are likely to bring on a paroxysm; he should take care not to become over-fatigued mentally or physically and should never over-load his stomach. The diet should be of simple and easily digested foods; intestinal fermentation and constipation should receive appropriate treatment. Alcohol in excess should be forbidden; tea, coffee, and tobacco should be interdicted; even a room in which others are smoking should be avoided by the patient.

The attack may be relieved by the inhalation of amyl nitrite. This drug is dispensed in glass capsules which contain 3 to 5 minims (0.20 to 0.33) and of which the patient may easily keep several in his pocket for use in emergency; at the beginning of the paroxysm one is broken upon the handkerchief and its fumes are inhaled. If amyl nitrite alone fails to benefit, the following capsule may be prescribed and may afford relief within a few moments: ℞ glycerylis nitratis, gr. $\frac{1}{100}$ (0.0006); mentholis, gr. $\frac{1}{50}$ (0.0012); amylis nitritis, ♏ $\frac{1}{4}$ (0.016); oleoresinæ capsici, gr. $\frac{1}{100}$ (0.0006). Misce et fiat capsula numero i. Signa, take one capsule at the beginning of an attack. In obstinate instances a hypodermatic injection of morphine sulphate, gr. $\frac{1}{4}$ (0.065) with $\frac{1}{100}$ of a grain (0.0006) of atropine sulphate may be given and until its effect is evident inhalations of chloroform or æther should be administered. The application of heat in the form of compresses, a hot water bag or mild mustard poultices, to the chest may ease the patient and cold compresses may act as well. When failure of the heart's action is present alcohol and ammonium, especially the aromatic spirit, are indicated.

During the intervals of the attacks the iodides should be administered if there are signs of arteriosclerosis, and glyceryl nitrate, if there is any tendency to arterial contraction should be given in doses of $\frac{1}{100}$ to $\frac{1}{50}$ of a grain (0.0006 to 0.0012) every three or four hours until its physiological effect is evidenced by flushing of the face or a feeling of fulness in the head. A combination of arsenic and potassium or sodium iodide often acts better than the iodide alone. The following formula is suggested: ℞ sodii arsenatis, gr. v (0.33); sodii vel potassii iodidi, ℥ss (15.0); aquæ destillatæ, q.s. ad ℥iv (120.0). Misce et signa, one teaspoonful (4.0) thrice daily after meals. Usually the administration of the iodides should be omitted for about ten days of every month; during the interval glyceryl nitrate may be given. This intermittent employment of the

iodides may be continued for years. If the iodides are not well borne the tincture of iodine in doses of 10 drops (0.66) twice a day may be substituted. Warm carbonic acid gas baths (see p. 551) are often serviceable. Digitalis should not be given.

In *pseudo-angina* of the neurotic type we should employ the means suitable to hysteria of other forms, especially galvanic electricity and hydrotherapeutic measures. Musk, asafœtida, valerian and monobromated camphor in ordinary doses may be employed, and the tincture of cratægus oxycantha in 10 to 20 drop (0.66 to 1.33) doses is suggested. Sodium iodide may be administered in 2 or 3 grain (0.13 to 0.20) doses three times a day as a preventive measure.

DISEASES OF THE BLOOD-VESSELS.

ARTERIOSCLEROSIS.

Synonyms. Chronic Endarteritis; Arterio-capillary Fibrosis; Atheroma of the Blood-vessels.

Definition. A chronic inflammatory process affecting first the intima of the arteries, but later spreading to the media and adventitia, and characterized by an increasing thickening and loss of flexibility of the arterial wall.

Ætiology. Thickening of the arteries is one of the changes which occur gradually as the years of life advance, but the tendency to its occurrence is very variable, depending upon a number of factors. Heredity has a certain influence and the affection is more common in men than in women. Other influences which bear a direct relation to the incidence of arteriosclerosis are over-eating and drinking, a life at high nervous pressure, excessive prolonged muscular exertion, chronic diseases such as gout or plumbism, the late changes due to syphilitic poison and the degenerations occurring in the acute infectious diseases, especially enteric fever. The abuse of alcohol in the light of recent research is beginning to be considered a less important ætiological factor than formerly. Clinicians differ as to the influence of renal disease upon the production of arterial degeneration but it is probable that there are two types, one in which the arterial change is primary and the other in which this is secondary to the renal affection. Whether chronic hypertension in the vascular system influences the production of arterio-capillary fibrosis or whether the former is the result of the latter is also a source of difference of opinion but it seems to be an assured fact that increased tension may exist primarily in certain subjects and that these later exhibit arterial degeneration. Arteriosclerosis is often associated with thyroid enlargement.

Pathology. The arterial wall having been weakened through some degenerative influence, a hyperplasia of the intima takes place in order to restore

the normal calibre of the vessel, or to compensate for the dilatation of the artery which has followed an increase in blood-pressure, there is an increase in the intimal connective tissue.

The morbid changes may involve the aorta alone or in connection with other groups of arteries, or the whole arterial system may be affected. The cerebral and coronary arteries are common seats of arteriosclerosis while those of the viscera are seldom diseased. When the sclerosed vessel is so situated as to permit of examination during life, as in the case of the temporals and radials, it may be visibly enlarged, tortuous and even beaded in appearance. To palpation it is hard and it may be rolled under the finger. The small internal vessels may be found to exhibit whitish patches of atheroma. The lining of the affected arteries is rough and their calibre is lessened. Microscopically the intima in the earlier stages presents certain thickened yellowish areas of cell-infiltration, later these patches soften and disintegrate, forming the atheromatous abscesses, the contents of which is a granular *débris* consisting of cells which have undergone fatty degeneration and crystals of cholesterin. The later stage of the abscess is an ulceration which may extend through the intima and finally lead to aneurysm. Still later the media and adventitia are involved and become infiltrated with connective tissue which may degenerate and lead to atheromatous cysts, which, like the abscesses of the intima, may ultimately become ulcers. Deposits of calcium salts may take place in the new connective tissue growth.

The media or muscular coat may undergo calcareous degeneration without associated other change, this form of arteritis being a common senile lesion.

The results of arterial degeneration are a rigidity and narrowing of the lumen of the affected vessel which causes a loss of elasticity, a slowing of the circulating blood current and heightened blood-pressure. As a consequence the left ventricle of the heart becomes hypertrophied. Ultimately the interference with the circulation brings about a defective state of nutrition of the heart muscle, the parenchyma of the kidneys and other viscera, which is followed by interstitial changes in these organs. The vascular changes also predispose to the occurrence of thrombosis, embolism and rupture, which, taking place in the cerebral circulation, result in apoplectic attacks. Rupture is often preceded by aneurysmal dilatation of the affected artery due to weakening of its wall by degeneration.

Symptoms. The arteries which lie near the surface may be visibly tortuous and enlarged and the examining finger easily detects their thickened walls and the increase of vascular tension. The normal artery may be so compressed by the finger that its outline can scarcely if at all be made out, and even if increased tension is present, the pulsation upon the distal side of the compression is obliterated. The atheromatous vessel can be rolled beneath the finger and even firm pressure is not sufficient to wholly obliterate the

pulsation beyond the compression. The physical signs of left ventricular hypertrophy are present and the second aortic sound is clear, sharp and accentuated—a very important sign. It must not be forgotten that, while the arteries which are palpable may be in normal condition, those elsewhere may be the seat of advanced disease. The pulse is hard and tense and may be retarded, i.e., the apical impulse may occur an appreciable time before the wave reaches the wrist. If hypertension is present the pulse rate is not lessened by changing from standing to a recumbent posture (Huchard's sign).

When the coronary arteries are involved the heart may become the seat of fibroid myocarditis or cardiac aneurysm, sudden death from thrombosis may occur or the patient may suffer from attacks of angina pectoris; even cardiac rupture may take place. If dilatation succeeds upon the ventricular hypertrophy the symptoms of this condition are present.

Arteriosclerosis of the cerebral vessels causes dizziness and insomnia and predisposes to the various degenerative conditions which may result from insufficient blood supply of the brain. Apoplectic attacks are common and the occurrence of temporary paralyses or of aphasia, which may last but a few hours and then entirely disappear, is not infrequent. The pathogenesis of these latter is not satisfactorily explainable. The Adams-Stokes syndrome has been observed.

The atheroma of the arteries within the kidneys results in an arterial nephritis (see p. 696).

Intermittent claudication (Charcot's symptom) a condition characterized by lameness, muscular pain and weakness of the legs with numbness, tingling and various other disorders of sensation occurring after slight exertion, is a symptom which has recently caused considerable discussion. It is supposed to be due to the diminished blood supply dependent upon the arterial disease. Examination reveals congestion of the lower extremities, thickening of their arteries and perhaps absence of pulsation in the dorsalis pedis artery.

The occurrence of embolism or thrombosis in the terminal arteries of the extremities leads to gangrene.

The prognosis is variable. So long as the compensatory hypertrophy of the heart is able to maintain a good circulation the subject of even advanced arterial disease may live in comfort for years but there is always the possibility of the incidence of cerebral apoplexy, the rapid development of renal disease or of loss of cardiac compensation.

Treatment. In the early stages before the onset of symptoms the patient's condition should be explained to him and he should be told that he may, to a considerable extent, delay and perhaps escape the discomforts and dangers to come by regulating his mode of life. Both mental and physical fatigue should be avoided and the use of alcohol should be forbidden. If there is objection to entirely giving up this and tobacco, they must be used

only with the greatest moderation. Moderate exercise may be taken and daily walks should be advised. Cool bathing, followed by massage and friction, is beneficial. Over-eating must be restricted and the character of the food should be regulated. Meat should be reduced to a minimum since it contains a large amount of tissue forming elements and extractives. Foods rich in calcium salts, such as milk, cheese, rice, etc., theoretically are contra-indicated, but practically it seems to be more important to restrict the quantity of food than its quality. A mixed diet, small in amount and consisting of milk, best taken diluted with mineral water, eggs, vegetables and a moderate quantity of fresh well-done meat is best. Little fluid should be taken with meals. Exercise in the fresh air is important and frequent vacations are to be advised. The preferable climate is one of mild and equable temperature and of low altitude; the subjects of arteriosclerosis do not usually do well above a level of 600 to 800 yards.

The digestion should be kept in as normal a state as possible and intestinal fermentation and constipation if present should be corrected. The routine unloading of the bowels every few weeks by means of a course of fractional doses of calomel followed by a saline is often a source of considerable relief to the patient after the symptoms of venous congestion have become manifest.

Since the presence of arteriosclerosis is in great measure the result of the continued maintenance of an increased blood pressure, in the prophylaxis of this condition all means to prevent and to lessen hypertension should be employed.

It is possible that we may delay the further formation of connective tissue within the walls of the arteries and less so that the absorption of that already present may be promoted by means of the iodides. Sodium iodide is preferred by some clinicians because it is better tolerated than potassium iodide; the former is, however, less active than the latter and consequently should be given in larger dosage to secure an equivalent effect. Either may be taken in doses of 10 to 20 grains (0.66 to 1.33) three times a day but in order to establish a tolerance the beginning dose should be small, 3 to 5 grains (0.2 to 0.33) and gradually increased. The iodide treatment may be continued for a number of years with intervals of omission such as one week every month or one month in every six.

In conditions of hypertension the nitrites should be freely used, preferably erythrol tetranitrate in doses of $\frac{1}{10}$ to $\frac{1}{2}$ a grain (0.006 to 0.032); this drug is usually well borne and may be given for considerable periods without increasing the dose. Glyceryl nitrate in doses of $\frac{1}{100}$ to $\frac{1}{50}$ of a grain (0.0006 to 0.0012) is also reliable. Attacks of marked dyspnœa associated with high arterial tension may be relieved by venesection.

Recently Trunecek's artificial serum has been much employed in arterial degeneration. This substance contains the normal blood salts and is sup-

posed to better the nutrition of the artery wall by rendering the blood more nearly normal in constituency. It may be given in tablets each of which contains sodium chloride, 6¼ grains (0.4), sodium sulphate, ⅝ grain (0.04), magnesium phosphate and sodium carbonate, of each ¼ grain (0.015), sodium phosphate and calcium glycerophosphate, of each ⅕ grain (0.0125). Of these two should be given three times a day.

The feeble heart and the palpitation which occur in the later stages should be treated according to the methods described in previous sections. When digitalis is prescribed arterial dilators should always accompany it. Strophanthus is often the preferable heart stimulant because of its less vaso-constrictor action.

Coronary arteritis should be managed in accordance with the principles suggested in the section upon angina pectoris, and the treatment of the renal type of arterial degeneration is discussed in the chapter upon arterial (interstitial) nephritis.

In all instances in which there is a syphilitic element in the history a course of mercurial and iodide treatment is indicated.

ANEURYSM.

Definition. A dilatation, more or less circumscribed, of a blood-vessel.

Aneurysms occur in various forms.

1. *True aneurysm*, one in which the wall of the dilatation, at first, at least, is composed of all three coats of the artery. Of true aneurysms there are several subdivisions: *a. Fusiform aneurysm* in which the dilatation is spindle shaped and involves the entire circumference of the vessel wall.

b. Sacculated aneurysm in which the dilatation involves but a part of the circumference and communicates with the lumen of the artery, from which it is an offshoot, by an opening of varying size.

c. Cirsoid aneurysm is a tortuous and irregular dilatation involving a medium sized artery and its branches. This condition is analogous to the varicosities which occur in veins.

2. *False aneurysm* may occur as a result of a traumatism which weakens the resistance of the intima to the blood pressure and this coat is consequently pushed through the elastic muscular coat and a dilatation results which involves only the intima and the adventitia. Injuries to blood-vessels may also cause the so-called *arterio-venous aneurysm* which is the term applied to a communication between an artery and a vein; the latter is dilated and tortuous and the condition is also denominated *aneurysmal varix*. If a saccular dilatation is present at the junction of the two vessels the lesion is called a *varicose aneurysm*. The *dissecting aneurysm* may likewise result from trauma. It is usually observed in the aorta; the blood as a consequence of the injury to the

inner coats is able to force its way between these and the adventitia and may separate these layers for a considerable distance and finally form a complete double tube.

Ætiology. Aneurysms are more frequent in males than in females and are most usual after middle life when the degenerative processes have begun. The causes of aneurysm, other than trauma, are practically identical with those of arteriosclerosis, syphilis being perhaps the most common single ætiological factor. The aortitis resulting from luetic disease leads to weakening of the vessel wall and consequent dilatation in numerous instances. The lodgment of emboli in smaller vessels is often followed by aneurysmal dilatation behind the stoppage and if the embolus is septic, infection follows. Compression is said to exert a certain influence in the causation of aneurysm, the popliteal variety being said to occur as a result of frequent crossing of one knee over the other. The lesion is also met in multiple form in malignant endocarditis, where, in addition to the valvular ulcerations, aortic aneurysms may be formed.

Aneurysm of the Thoracic Aorta.

Aortic aneurysm is usually met in subjects of beginning arteriosclerosis before the compensating growth of connective tissue in the media has taken place, and as an exciting cause an unusual muscular exertion, which weakens or ruptures the intima leading to subsequent dilatation, may be considered. The aneurysm may be either fusiform or sacculated, the latter being the more common. The most frequent situation is at the beginning of the aorta just behind the pulmonary artery and as a result of compression of this vessel there may be hypertrophy of the right ventricle. Perforation into the pulmonary artery or into the pericardium may take place. An aneurysm of the ascending aorta just behind the junction of the gladiolus and manubrium may project forward and finally rupture externally. Aneurysm of the convexity of the arch pointing toward the right becomes adherent to the pleura and ultimately may erode the lung and result fatally with hæmoptysis. Dilatation at the summit of the arch presses upon and may erode the trachea. Aneurysm of the descending aorta usually protrudes posteriorly and laterally.

Symptoms. These are chiefly due to the pressure of the tumor upon the neighboring structures. Aneurysm of the ascending portion of the arch causes pain through pressure upon the sternum and, in late stages, an external tumor. By pressure upon the superior cava or the subclavian vein it causes congestion and œdema of the head and arm. If of large size the tumor may displace the heart downward and to the left, or extending to the right, cause paralysis of the right vocal cord due to pressure upon the right recurrent laryngeal nerve. Aneurysm in this situation, as stated above, may rupture into the pericardium, the pleura or, rarely, externally.

A peculiar dilatation of the first part of the aorta, first described by Hodgson and still known as *Hodgson's disease*, is not uncommon. The vessel forms a pouch beginning just above the semilunar valves and more rarely involving only one side of the aorta. The resulting symptoms are dyspnœa due to tracheal pressure, palpitation, cough with mucoid expectoration, insomnia and attacks of fainting. The *physical signs* are an increased dulness over the ascending aorta demonstrating an increase in the width of the aorta, prolongation of the systole, and cardiac dilatation with the murmur of a relative aortic insufficiency.

Aneurysms of the transverse portion of the aorta cause pain due to pressure upon the vertebral column if they protrude posteriorly or to erosion of the sternum if they grow forward. The external tumor is usually in the midline of the chest or to the right of the sternum. Pressure upon the trachea causes cough and dyspnœa, upon the œsophagus dysphagia, upon the left recurrent laryngeal nerve paralysis of the corresponding vocal cord with aphonia or hoarseness, upon the sympathetic nerve, first, pupillary dilatation, later, contraction. Large aneurysms of the arch may fill the entire upper mediastinum from pleura to pleura and from sternum to vertebral column.

Aneurysm involving the descending arch causes a tumor extending posteriorly and to the left with consequent vertebral pain and even a protruding tumor adjacent to the left scapula. Pressure on the œsophagus is frequent and rupture into the pleura or into the lung itself may occur.

Aneurysm of the thoracic aorta below the arch may be present without giving rise to suggestive symptoms. In other instances there is pain due to vertebral pressure and interference with swallowing. The tumor may manifest itself externally, usually to the left of the vertebral column.

The pressure pain of aneurysm is not always present but may be a very distressing symptom; it may occur in paroxsysms and is sharp and cutting in character especially when the tumor is eroding a bone. In involvement of the first part of the aorta, anginoid attacks are frequent. Pressure upon the spinal nerve roots may cause pain radiating down the arm.

Cardiac and Circulatory Symptoms. These consist of a relative aortic insufficiency, occurring in dilatation of the ascending limb of the arch, and muscular hypertrophy in a certain number of instances. The pressure of the aneurysmal tumor upon the veins draining the arm and head causes flushing and œdema of these parts. Pressure may be exerted upon the pulmonary artery and at times an insufficiency of the valve may result. Rupture of the aneurysm into this vessel may occur.

Respiratory Symptoms. Dyspnœa due to pressure on the trachea or a bronchus is common in dilatations of the transverse portion of the arch. Cough may also result from this pressure or from accompanying bronchitis; the sputum may be mucoid or thick and purulent. The typical brassy cough of

aneurysm which presses upon the recurrent laryngeal nerves may be present and, associated with it, hoarseness or aphonia are not uncommon. Hæmoptysis occurs as a result of rupture of the aneurysm into the trachea or bronchi, of erosion of pulmonary tissue or from the granulation tissue developed in the trachea at the site of the pressure. Hæmorrhage from rupture usually causes death; other forms of hæmorrhage may gradually exsanguinate the patient and prove very exhausting but seldom of themselves result fatally.

Other pressure symptoms are dysphagia, occurring when the lumen of the œsophagus is encroached upon by the tumor, and pupillary and vaso-motor manifestations which are caused by interference with the normal functions of the sympathetic nerve. These are most common in aneursym of the ascending arch and consist, if irritation only is the result of the pressure, of pupillary dilatation and paleness of the face upon the same side. More marked pressure causes paralysis of the nerve and consequent contraction of the pupil and congestion of half the face, sometimes with hyperidrosis.

Physical Signs. Inspection may reveal a pulsation above the base of the heart. This may be invisible except in strong light and is more likely to appear upon the left than on the right side of the sternum. The impulse may also be visible in the supra-sternal notch. When the aneurysm has reached sufficient size a bulging of the chest or a distinct tumor becomes apparent, to the right of the sternum if the ascending portion of the arch is affected, behind and above the sternum if the lesion is of the transverse portion, to the left if the dilatation involves the descending portion. Finally the tumor eats its way through the intervening structures until it is covered merely by the skin which becomes smooth, tense and glossy. The pulsation of the tumor is ventriculo-systolic in time and expansile in character. The apex beat of the heart may be displaced downward by the pressure of the growth or to the left as a result of ventricular hypertrophy. Pressure upon the venous circulation of the neck causes congestion and œdema of one or both sides depending upon the site of the interference with circulation. Pressure upon the innominate or subclavian veins produces interference with the circulation of the upper thorax and arms. Pupillary abnormality may be noted as a result of pressure upon the sympathetic nerve. Laryngoscopic examination shows paralysis of one or other of the vocal cords according to the situation of the lesion. Visible depression of the larynx with each cardiac contraction may be noticed when the trachea is put on the stretch by holding the head back.

Palpation confirms the evidence obtained by inspection. The pulsation is felt to be distinctly *expansile* in character. A ventriculo-systolic thrill and the diastolic shock, an important sign, due to the recoil blow of the tumor upon the closed aortic valve, may be present. The examiner may elicit tenderness upon pressure over the aneurysm; if the dilatation is large and superficial it should be palpated and percussed with great care. The tracheal

tug is elicited by inserting the thumb and forefinger beneath the cricoid cartilage and lifting this structure. With each systole a downward pull may be felt; a sidewise movement may also be detected (Cardarelli's sign).

Percussion. The note over all but small and deeply situated aneurysms is dull or flat and this note may be elicited over the parts of the lung nearest to the tumor as a result of compression of this organ. Aneurysm of the ascending arch causes a change in the resonance over the upper ribs and intercostal spaces upon the right side near the sternum. Dulness over this structure and to its left is caused by dilatations of the transverse portion; the change in note over aneurysms of the descending arch is in front, obscured by the normal cardiac dulness and the deep situation of the vessel. Dulness is, however, in instances of aneurysm of this situation, perceptible posteriorly in the region of the left scapula and between this bone and the vertebral column.

Auscultation is often unproductive of any evidence; in other instances it may reveal most characteristic signs. A variety of murmurs may be produced in aneurysms. A ventriculo-systolic murmur or even a double *bruit* may be present, the ventriculo-diastolic sound being the result of relative insufficiency of the aortic valve. In quality the aneurysmal murmur may be rough, soft or musical and it is probably due to the passage of the blood current over the roughenings in the lining of the dilatation. The ventriculo-diastolic *bruit* which may be heard at times in aneurysms distant from the aortic valve may be caused by the propulsion of the blood through the sac or to its recoil as it propels the blood stream onward. In the larger aneurysms of the arch an important sign is a sharp, ringing second aortic sound. This may be absent and is not marked if the aortic valve is unsound. A systolic murmur may be audible over the trachea or even at the patient's open mouth (Drummond's sign), and in latent aneurysm there may be a systolic sound in the brachial artery (Glasgow's sign).

Changes in the pulse of the peripheral arteries are not infrequent. The chief of these is a retardation of the impulse in arteries beyond the dilatation. If there is enfeeblement or delay of the right radial pulse the dilatation will be on the right side and affecting the innominate artery. If the change in radial pulse is upon the left side the subclavian artery is probably involved. Large thoracic or abdominal aneurysm may cause diminution or even absence of pulse in the vessels below the lesion.

X-ray examination shows that aneurysm of the ascending aorta usually casts a shadow more to the right than to the left of the sternum, above the heart, which by localization would be found to be nearer the anterior than the posterior wall of the chest.

Dilatations of the transverse portion cast a shadow slightly to the left of the sternum extending well into the neck and nearer the anterior thoracic

wall; if the lesion is of the descending arch the shadow is cast to the left of the sternum and nearer the posterior wall of the thorax.

The diagnosis. Tumors of the mediastinum may be difficult of differentiation from aneurysm of the arch. The signs elicited by percussion may be identical and, while the pain is often similar to that of aneurysm, there is no *expansile* pulsation. Cardiac and circulatory symptoms are not features of neoplasm, there is no tracheal tug nor are laryngeal symptoms present. A febrile movement, a cachectic condition and lymphoid enlargements are to be associated with mediastinal new growth; pressure upon the œsophagus or bronchi is common to both tumor and aneurysm.

Pulsating empyema in the region of the heart may be differentiated from aneurysmal dilatation by the absence of the diastolic shock and tracheal tug; the pulsation is expansile, however, but less firm, heaving and more diffuse. The history also should aid in the separation of the two conditions and an assured diagnosis may be made by the use of the exploring needle.

Aneurysm may be mistaken for aortic insufficiency with pulsation of the vessel but in the latter condition we have no pressure symptoms nor tracheal tug, there is likely to be a rheumatic history and the patient may be young or only middle aged and not a subject of arteriosclerosis. Cardiac hypertrophy is more frequent in the cardiac lesion than in aneurysm.

The prognosis. While unsuspected aneurysms are often found during autopsy after death from other causes, the prognosis, especially when the physical signs and symptoms are well marked, is always grave and death results from rupture of the sac, erosion of a blood-vessel, etc. Spontaneous cure of small sacculated aneurysms may occur, the cavity becoming gradually filled with fibrin and later shrinking, the sac becoming ultimately obliterated. Aneurysms slowly eroding the trachea or a bronchus may cause repeated small hæmorrhages and cause death from increasing weakness. Under favorable circumstances and proper treatment the patient may be made comfortable and his life prolonged for a considerable period. Cure is possible in a certain number of patients.

Aneurysm of the Abdominal Aorta.

Aneurysm of this vessel is not of common occurrence, a visible and palpable pulsation of the abdominal aorta is, however, frequently observed The usual site for abdominal aneurysm is near the origin of the cœliac axis. Extension of the tumor backward results in erosion of the vertebral column and causes a constant lumbar pain due to pressure on the splanchnic nerves and solar plexus, or a neuralgic pain, due to pressure upon the lumbar nerves, which may be referred to the anterior abdomen, the testicles, down the limbs, and in fact to any point to which the affected nerves are distributed. Growth

of the dilatation forward causes pressure upon the digestive organs and results in gastric pain, vomiting, and diarrhœa. In certain instances there are but few and ill-marked symptoms, as in a patient observed by the writer in one of the workmen attached to Bellevue Hospital, whose attention was first called to his disease by noticing the rise and fall of the book which he was reading and which rested upon his epigastrium, the man meanwhile lying on his back.

The physical signs are analogous to those of thoracic aneurysm. Pulsation may be visible and even a definite tumor may be made out in certain subjects. A thrill may be present and upon palpation, particularly in thin subjects, the aneurysm may be grasped and its expansile pulsation distinctly perceived; this last is essential to the diagnosis for it is not present in instances of pulsating aorta. A ventriculo-systolic *bruit*, more rarely a double murmur, may be audible and the pulses in the legs are usually retarded and diminished. Certain neoplasms in the epigastric region may be mistaken for aneurysm but never possess true expansile pulsation.

The prognosis is unfavorable, death ensuing from rupture, obliteration of the vessel by a gradually forming clot or embolism of other arteries, more particularly the superior mesenteric.

Aneurysm of the Branches of the Abdominal Aorta.

Aneurysm of the *cœliac axis* may occur by itself or in connection with dilatation of the aorta itself. The symptoms are similar to those of aneurysm of the aorta at this level; the origin of the tumor may be traumatic.

Aneurysm of the *splenic artery* is usually of small size but may be large enough to be made out by palpation. In such instances the physical signs are those of a tumor, dull on percussion, the dulness continuous with that of the spleen, and pulsation; a murmur may not be present; the symptoms are those of digestive disturbance with epigastric pain and hæmatemesis. Rupture into the bowel may take place with fatal hæmorrhage.

Aneurysm of the *hepatic artery* is rare; its symptoms are not characteristic. The dilatation is usually small but the liver itself is likely to be the seat of marked enlargement.

Aneurysm of the *superior mesenteric artery* is less uncommon but is difficult of diagnosis during life.

Aneurysms of the *renal arteries* are usually small and often traumatic in origin. Pulsation and murmurs are inconstant, retro-peritonæal hæmorrhage may take place from rupture.

Aneurysm of the *pulmonary artery* is extremely rare; it is evidenced by a tumor at the left of the sternum at the level of the second intercostal space. Other local symptoms of aneurysm are present but the *bruit* is often absent.

There is no recurrent laryngeal pressure but marked dyspnœa is present with œdema and lividity of the face.

The Treatment of Aneurysm.

Saccular aneurysms communicating with the aorta by a small opening may in a certain number of instances be cured. The treatment consists in the employment of measures which favor the formation of a permanent clot within the sac which shall finally become solid and entirely occlude the dilatation. To further this occurrence the most satisfactory method is that of Tufnell, of Dublin, who advises complete mental and bodily rest in the recumbent position. This reduces the blood pressure and volume of blood forced through the arterial system by lessening the force and frequency of the cardiac contractions. The effect of this treatment is furthered by restricting the diet. That prescribed by Tufnell is as follows: Breakfast and supper each to consist of 2 ounces (60.0) of bread and butter and 2 ounces (60.0) of milk; dinner, 2 to 3 ounces (60.0 to 90.0) of meat and 3 to 4 ounces (90.0 to 120.0) of milk or claret. This regimen is very rigid and necessitates no inconsiderable amount of courage and determination on the part of the patient. It is probable that the solids may be less carefully restricted if it is remembered that in order to maintain a continuously low blood pressure, but little fluid should be allowed. The treatment should be continued for several months at least and longer if the patient will endure the deprivation; improvement is evidenced by a diminution in the pulsation and size of the tumor and an amelioration of the pain. It is important in this and other methods of treatment that the bowels should be kept freely open in order that the blood pressure shall not be increased by the incidence of constipation or of straining at stool. Balfour advises the employment of iodide of potassium in connection with the Tufnell method. Large doses are unnecessary, a proper amount being from 10 to 20 grains (0.66 to 1.33) three times daily. This drug affords relief from the pain in a certain degree, lowers the blood pressure and is considered by some to thicken the blood by causing an increase of the secretions; it may be given to advantage to non-syphilitic patients as well as to those who give a history of luetic disease.

Valsalva has recommended venesection, and the removal of small amounts of blood may be practiced with the result of relieving the pain and lessening the blood pressure.

The administration, in connection with other treatment, of calcium lactate, 20 grains (1.33) three times a day is suggested. This drug markedly increases the coagulation power of the blood and should aid in the formation of the clot in the aneurysmal tumor. It should not be forgotten, however, that the continuation of this salt for more than three or four days at a time results in diminished coagulability.

The treatment by means of hypodermatic injections of gelatin has been employed by Lanceraux who has reported good results although those obtained in this country have been less favorable. A one percent. solution of gelatin in normal saline (0.9 percent.) solution is used. Having been previously sterilized, 2 to 5 ounces (60.0 to 150.0) of the solution at a temperature of about 100° F. (37.8° C.), are injected into the subcutaneous tissue of the thigh or buttock; the procedure is repeated from fifteen to twenty times at intervals of from six days to two weeks. The gelatin is supposed to increase the coagulability of the blood. Tetanus has been reported as following this treatment in certain instances but this accident is doubtless due to contamination of the solution. The internal administration of gelatin in doses of 4 drachms (15.0) daily has been suggested as a substitute for its hypodermatic employment.

Dyspnœa and venous congestion of the face and upper limbs may be relieved by venesection and if double abductor paralysis of the vocal cords, as shown by laryngoscopy, is responsible for laryngeal œdema, intubation or tracheotomy is to be considered. Pain at the site of the tumor, especially if this is evident externally, may be lessened by the application of an ice coil or by the application of an elastic bandage. It is hardly necessary to suggest that the aneurysm under such circumstances must be carefully protected from external violence.

The pain in advanced stages of the disease may necessitate the exhibition of morphine hypodermatically.

Cardiac over-action may be controlled by the ice coil and small doses of aconite, or veratrum viride. Cardiac stimulants, especially digitalis because of its action in raising the blood pressure, should be prescribed with the greatest care.

In aneurysms of the fusiform type or in the sacculated form when the communication between the dilatation and the vessel from which it has originated is large, there is little hope of cure by means of the methods suggested above, but the patient may be allowed to continue in his occupation under the restrictions advised in the section upon the management of arteriosclerosis, such as abstention from muscular and mental exertion, over-eating, etc.

Certain *surgical measures* may result in cure in properly selected patients. Peripheral aneurysm may be wholly excised or various forms of ligation may be performed, for a description of which the reader is referred to works upon surgery. Continuous compression in this form of aneurysm may be employed with success. It consists in the obliteration of the sac by means of the pressure of the finger for two to three days, relays of students or nurses being engaged for the purpose. Among the less radical surgical procedures which have been followed by cure, are the introduction into the sac of considerable lengths of fine steel wire, horse hair, catgut or silk. The object is to hasten coagu-

lation by the presence of the foreign body. The statistics of this method of treatment are not such as to recommend its frequent employment.

Galvano-puncture may be performed and is worthy of trial. The technique consists in introducing two needles into the sac through which a mild galvanic current is passed. The needles must not be in contact inside the tumor. Another method consists in the introduction into the dilatation of a coil of fine gold, silver or steel wire through which the current is sent. The procedure is not without danger; embolism, secondary bulging of the sac wall or obliteration of a smaller artery emerging from the dilatation may result.

Simple irritation of the lining of the sac by means of a sterilized needle which has been plunged through its wall is a simple and safe procedure.

The needle may be left in place for twenty-four hours, continuous irritation being carried on through the movement of the sac with the cardiac systole. It must be remembered that in undertaking any of the above described operations the most thorough asepsis of field, instruments and operator's hands is essential.

The treatment of abdominal aneurysm should be carried out upon lines similar to those applicable in the case of aneurysm of the thoracic aorta.

CHAPTER VIII.

DISEASES OF THE RESPIRATORY SYSTEM.

DISEASES OF THE NOSE.

ACUTE RHINITIS.

Synonyms. Acute Coryza; Cold in the Head.

Definition. An acute inflammation of the nasal mucous membrane.

Ætiology. It is probable though not certain that germ infection plays a part in the causation of "cold in the head" although the attack proper is usually brought on by exposure, wetting of the feet, etc.

Pathology. The mucous membrane of the nose is first dry, red and swollen, later there is hypersecretion of thin watery mucus which later may or may not become muco-purulent and viscid.

Symptoms. The first of these is usually a feeling of fulness in the head and difficulty in breathing through the nose, the result of the hyperæmia of the nasal lining; sneezing may be present and there may be a slight elevation of temperature. After a number of hours the watery nasal discharge appears. It is often profuse and may be so irritating in character as to cause excoriations of the nostrils and upper lip. After a day or two the secretion becomes thick, yellowish and tenacious; this persists for a few days and then disappears.

Treatment. If taken early, abortive measures may succeed. These consist in free purgation by means of fractional doses of calomel followed by a saline, a single large dose of quinine, 10 to 15 grains (0.66 to 1.00), and on going to bed, a Dover's powder and a glass of lemonade as hot as it can be taken. Such means are likely to produce free diaphoresis and may result in prevention of further manifestation of the rhinitis. The early use of the so-called rhinitis tablet may also mitigate the inflammation. Such tablets may consist of: Camphor $\frac{1}{2}$ grain (0.03) quinine sulphate $\frac{1}{2}$ grain (0.03), extract of belladonna $\frac{1}{10}$ grain (0.006), or, monobromated camphor $\frac{1}{2}$ grain (0.03), euquinine $\frac{1}{2}$ grain (0.03), extract of hyoscyamus $\frac{1}{10}$ grain (0.006); one or two of either of these may be given every half hour until six have been taken.

The hyperæmia of the nasal lining may be reduced by a spray of adrenalin chloride, 1–1000 solution, one part to 0.9 percent. salt solution eight parts or a spray containing antipyrine 10 grains (0.66), cocaine hydrochloride 2 grains (0.13), camphor water 3 drachms (12.0), water to 1 ounce (30.0). Previous to

using either of these the nose should be douched or sprayed with an alkaline solution, Dobell's for instance, in order to remove any secretion and to allow free contact of the medicated spray to the swollen tissues. Sprays containing cocaine should rarely be given to the patient for his own use since there is possibility of the acquirement of the habitual use of the drug. Simple alkaline, mildly antiseptic and oily sprays such as menthol gr. x (0.66) or oil of gaultheria, ♏v (0.33) to the ounce (30.0) of albolene may be used frequently and afford much relief; the inhalation of iodine, 2 or 3 grains (0.12 to 0.20) to the ounce (30.0) of æther is said to be another excellent means of lessening the nasal discomfort.

In children the use of sprays is attended with some difficulty but their noses may be easily cleansed by means of a minim dropper and any simple alkaline solution. It is also well to remember the irritating effect of the nasal discharge and provide against this by anointing the nostrils and upper lip with cold cream or vaseline.

The debility following acute coryza often is such that the exhibition of the various tonics, codliver oil, iron, the bitters and arsenic, is indicated.

HAY FEVER.

Synonyms. Vasomotor Rhinitis; Hay Asthma; Rose Cold; Autumnal Catarrh.

Definition. An acute catarrhal inflammation of the nasal mucous membrane usually associated with conjunctivitis and asthmatic symptoms and occurring in the early summer or the autumn.

Ætiology. The disease is more common in men than in women and is predisposed to by any intra-nasal lesion such as chronic inflammation, bony hypertrophies, polyps, etc., and the neurotic diathesis. The acuity of the attacks of this disease is induced by the inhalation of the pollen of various plants, irritating dust or odors, animal emanations, changes of temperature, nervous shocks, etc. Heredity plays a considerable part in the causation of this condition, and it is not uncommon in patients of lithæmic diathesis.

Pathology. This is merely that of an inflamed and hyperæmic nasal mucous membrane superadded in many cases to a chronic intra-nasal abnormality. From the nasal lining there is a profuse watery discharge, the result of a serous exosmosis from the blood-vessels of the part.

Symptoms. The onset of an attack often comes at the same time, even to a day, of each season and may begin suddenly or gradually. At first there is merely a tickling sensation in the nose and mouth often followed by uncontrollable and paroxysmal sneezing. The nasal mucous membrane becomes swollen and there is copious irritating discharge from the nostrils. The conjunctivæ are also involved as is shown by suffusion and increase of

lachrymal secretion, and in marked instances the catarrhal condition may spread to the ears as evidenced by tinnitus and impairment of hearing. There are often severe headache and marked mental depression.

In certain patients the attack is characterized by cough, with or without expectoration, and asthmatic dyspnœa.

Rhinoscopy reveals a turgescence of the nasal lining which is glossy, opalescent in hue and covered with a thin, viscid serous secretion.

Treatment. With regard to prophylactic and inter-paroxysmal treatment it is sufficient to insist that all pathological intra-nasal conditions should receive proper treatment by the rhinologist. The septum and the turbinates, particularly, should be carefully examined for abnormality.

The constitutional dyscrasia, nervous or lithæmic, should receive careful attention, especially for the month or so before an expected attack. The former may be benefited by combinations of the zinc salts, belladonna, phosphorus and arsenic. For the management of the latter see p. 263 and ff.

The prevention of an attack by change of climate, when convenient, is always advisable. A sea voyage taken at the time of an expected paroxysm will often prevent its occurrence as will residence in various mountain or sea side resorts such as those provided by the White, Catskill and Adirondack mountains and Beach Haven, N. J., Nantucket, Mount Desert, etc. The same climate will by no means be efficacious in all patients, consequently experimentation may be necessary before the proper one for an individual subject is found.

The local treatment of the attack consists in the use of various sprays and local applications of which probably the best is adrenalin chloride. This agent acts by constricting the swollen and inflamed mucous membrane and diminishing the secretion. It may be best applied by means of the nasal applicator or spray in strength of 1 to 2,000 or 1 to 4,000 in pure olive oil. An oily solution of 1 to 1,000 strength is obtainable and may be diluted as the patient requires. Before the use of the oily solution the nasal mucous membranes should be cleansed of secretion by means of an alkaline spray.

Cocaine sprays or applications, 2 to 4 percent. in strength, are useful but the danger of engendering the cocaine habit renders their routine employment ill-advised.

Suprarenal extract may also be given internally in doses of 5 to 10 grains (0.33 to 0.66) every two hours during an attack but should be stopped as soon as the physiological action of the drug, as evidenced by palpitation or vertigo, is noted. When these symptoms have disappeared the extract may be again administered in less frequent dosage, every three or four hours for instance, and the intervals gradually increased as the nasal symptoms become ameliorated.

Quinine in doses of 10 to 20 grains (0.66 to 1.33) a day may be given during

an attack and belladonna and potassium iodide are said to be of benefit at times. The nervousness and restlessness to which patients suffering from an attack of hay fever are prone may be controlled by the bromides, hyoscyamus or chloral, and the conjunctivitis may be relieved by the application of a saturated solution of boric acid or by dropping into the eyes every two hours a drop or two of the following formula: Zinc sulphate, 1 grain (0.065); camphor water, 1 drachm (4.0); saturated solution of boric acid to 1 ounce (30.0).

Recently there has been an attempt to elaborate antitoxins from the pollens of certain plants, notably, ragweed and golden-rod, which may be used as immunizing agents, and Dunbar asserts that he has prepared an efficacious serum by inoculating horses with a substance prepared from pollen and drawing from them the blood-serum. This antitoxin may be used in its fluid form, or dried to a powder, as a snuff, and excellent results are reported from its employment.

DISEASES OF THE LARYNX.

ACUTE CATARRHAL LARYNGITIS.

Ætiology. Acute laryngitis may be caused by exposure to cold and wet, or by the inhalation of irritating gases or dust. It is predisposed to by excessive smoking, the abuse of alcohol, excessive use of the voice and by previous attacks. It may complicate the acute infectious diseases. With it are frequently associated catarrhal inflammations of the nose, throat, trachea and bronchial tubes.

Pathology. Early in the inflammation the mucous membrane lining the larynx is reddened, congested and dry, after about twenty-four hours there is an increased exudation of mucus and a diminution of the redness and congestion; examination by means of the laryngoscope reveals swelling and redness of the lining of the larynx and of the true and false vocal cords.

Symptoms. Of these the most prominent is hoarseness; the voice is husky, reduced to a whisper, or lost. There is cough, at first dry and husky, later with the expectoration of mucus. At times it may be stridulous. There may be pain in the larynx which is increased on swallowing and in the severer instances there is a moderate rise of temperature. Dyspnœa may be present. This symptom varies in intensity from time to time and in rare instances respiration may cease and death result. Instances complicated by œdema of the glottis also suffer from dyspnœa depending upon the degree of the œdema. Usually the disease lasts from ten days to two weeks. Recovery is the rule.

Treatment. In the milder instances the patient need not be confined to bed nor need the diet be restricted, but he should be kept in a slightly damp

atmosphere at a temperature from 70° to 75° F. (20.5° to 24.0° C.). The pain and discomfort may be relieved by the application of hot or cold compresses or the ice coil to the throat. The cough may be controlled by the following formula: ℞ codeinæ, gr. v (0.33); aquæ amygdalæ amaræ, ℥ss (15.0). Misce et signa 5 to 15 drops (0.33 to 1.00) every two hours; small doses, gr. 1½ (0.10) of Dover's powder are also useful. The dryness of the mucous membrane and the hoarseness may be rendered less distressing by the administration of tartar emetic in doses of $\frac{1}{100}$ to $\frac{1}{50}$ (0.0006 to 0.0012) of a grain. As a sedative inhalation the following formula may be employed. ℞ potassii bromidi, gr. x (0.66); cocainæ hydrochloridi, gr. v (0.33); aquæ destillatæ, ℥v (20.0).

Frequent inhalations of medicated steam often afford relief. Many substances have been used a few of which are appended. Compound tincture of benzoin 1 to 128 of boiling water. Compound tincture of benzoin and paregoric of each 1 part to 128 parts of boiling water. Turpentine and eucalyptus may be used in the same fashion.

As the acuity of the inflammation subsides applications of tannin or alum mixed with an equal quantity of starch, should be made to the larynx, by means of the powder blower, or astringent sprays, such as zinc sulphate, gr. xxx (2.00) or zinc chloride, gr. xv (1.0) to the ounce (30.0) of water or liquor antisepticus or tincture of iron chloride, ♏xxx (2.00) to the ounce (30.0) of water, should be employed.

In the prolonged instances change of climate and the administration of tonics are indicated.

SIMPLE CHRONIC CATARRHAL LARYNGITIS.

Ætiology. Chronic catarrhal laryngitis may be the result of any of the causes predisposing to acute laryngitis, such as abuse of the voice in public speaking or singing, and it may follow repeated attacks of acute laryngitis. It is also predisposed to by nasal obstruction.

Pathology. Examination of the larynx reveals moderate swelling of the vocal apparatus, the mucous membrane is yellowish-red in color, the vocal cords are thickened, their edges are irregular and there is thickening of the mucous membrane lining the posterior commissure. Ulcers or erosions, when present always bilateral, may be observed over the processus vocalis. Either or both of the vocal cords may be relaxed.

Symptoms. Of these the most noticeable is hoarseness which may vary from a slight huskiness of the voice to almost complete aphonia. Use of the voice may cause pain. Cough, due to laryngeal irritation is a frequent symptom, and the patient may raise mucoid or muco-purulent sputum in small or, at most, moderate quantity.

Treatment. Persons subject to throat disorders should avoid undue exposure to cold and wet and excessive use of the voice. The abuse of alcoholic beverages and tobacco should be forbidden and the patient warned against the inhalation of dust and irritating vapors. In this connection the wearing of a respirator may be recommended, and, if convenient, a change of climate advised.

Any constitutional condition which may influence the local lesion should receive appropriate treatment, and all functional disturbances—digestive, etc.—should be regulated, as well as all pathological conditions of the nasal, naso-pharyngeal, or pharyngeal structures.

The local inflammation may be best treated by astringent sprays such as the following: Zinc chloride or sulphate 30 grains (2.0) to the ounce (30.0) of water or liquor antisepticus; iron and ammonium sulphate one drachm (4.0), or silver nitrate 10 grains (0.66), or tincture of iron chloride one to two drachms (4.0 to 8.0) to the ounce (30.0) of water; 2 to 3 percent. solutions of alum or 1 to 2 percent. tannic acid solutions are also useful. While the larynx is being sprayed the patient should be directed to inhale so that the medicament may be drawn into contact with the inflamed area; also it should be remembered that in order that the application may have its full effect, the larynx should be sprayed with an alkaline solution (dilute liquor antisepticus for example) before the use of the astringent.

Long standing instances with considerable hypertrophy of the tissues may be benefited by sprays of zinc iodide 15 grains (1.0) to the ounce of water or liquor antisepticus or of such a mixture as the following: ℞ iodi, gr. iv (0.24); potassii iodidi, gr. x (0.66); zinci iodidi, gr. xx (1.33); zinci phenolsulphonatis, gr. xx (1.33); liquoris antiseptici, ℥iv (120.0).

Applications by means of a brush are useful and any of the above astringents added to a half-ounce (15.0) each of glycerin and water may be used. A 10 percent. resorcinol solution may also be applied by this means.

Such applications as the above should be made daily at first, but later the interval may be lengthened, depending upon the success of the treatment.

The use of medicated steam inhalations such as those described under the treatment of acute laryngitis (p. 624) may be advisable, or solutions of alum 1 to 10 grains (0.065 to 0.66), iron perchloride, 2 to 5 grains (0.13 to 0.33) or zinc sulphate 1 to 5 grains (0.065 to 0.33) to the ounce (30.0) of water may be employed in the same manner.

Lozenges or troches may be employed for local effect and they may also have, through the stimulation of the mucous membrane of the throat, a reflex action upon the larynx. The drugs which may be used by this means are cubeb, ammonium chloride, benzoic acid, guaiac, rhatany, potassium chlorate and lactucarium. An astringent troche consisting of tannic acid 1 grain (0.065), gallic acid, catechu and kino each 2 grains (0.13), is often useful and

convenient where for any reason local treatment by sprays or direct application is not readily applicable. When irritating cough is present tablets of heroine—$\frac{1}{2\,4}$ to $\frac{1}{1\,2}$ of a grain (0.0027 to 0.0055)—may be prescribed.

Powder insufflation is found useful in many patients. Powders of equal parts of alum and starch, tannic acid and starch or borax and starch may be employed as well as sedative powders such as morphine acetate 2 to 10 grains (0.13 to 0.66) to iodoform 4 drachms (15.0).

Gargles are less effective than the foregoing means since it is very difficult to reach the site of the lesion by this form of treatment. They may be employed, however, if considered advisable, and may consist of alum, 1 drachm (4.0); zinc chloride, ½ drachm (2.0); zinc phenolsulphonate, 2 drachms (8.0); potassium chlorate, 2 drachms (8.0); phenol, 20 grains (1.33); acetic acid, 2 drachms (8.0) or boric acid, 4 drachms (15.0) to 8 ounces (250.0) of water.

SPASMODIC LARYNGITIS.

Synonyms. Catarrhal Spasm of the Larynx; False Croup; Spasmodic Croup.

Definition. An acute catarrhal inflammation of the laryngeal mucous membrane accompanied by a spasm of the laryngeal muscles.

Ætiology. This condition occurs in children from six months to five years of age; it is rarely met later. It is predisposed to by the presence of adenoids and enlarged tonsils, the breathing of over-heated or impure air and certain children seem more prone to attacks than others. The exciting cause is usually exposure to cold or a digestive disturbance.

Pathology. The mucous lining of the larynx, especially that part above the true vocal cords, is red and congested, later there is an excessive secretion of mucus. At the time of the attack there is superimposed upon the inflammatory condition a spasm of the laryngeal muscles, particularly the adductors.

Symptoms. During the day the patient suffers from little except slight hoarseness and nasal discharge. The laryngeal spasm usually occurs at night and often without warning. There is difficult and stridulous breathing and a croupy cough; at times the dyspnœa is so great that the child is in marked distress, the accessory muscles of respiration come into play, the face and extremities may become livid and the condition seems very alarming to the casual observer. There is rarely more than a slight febrile movement. The paroxysm lasts for several hours. During the following day the patient does not appear ill but the attack is likely to return for two or three nights, unless prevented by treatment, after which the symptoms, other than moderate hoarseness or cough, disappear. The condition, although distressing while it lasts, is never fatal.

Treatment. Prophylactic treatment consists in the removal of adenoids

and hypertrophied tonsils, attention to the condition of the digestion and to the diet and general hygiene of the patient.

The laryngeal spasm may be relieved by emesis which may be brought about by the administration of wine of ipecac in doses of ½ to 1 drachm (2.0 to 4.0) every five or ten minutes until effective, or of tartar emetic and powdered ipecac each $\frac{1}{100}$ of a grain (0.0006); the latter, however, should be repeated with caution because of the depressing effect of the antimony. Repeated doses of alum (gr. 5—0.33) in a little syrup or molasses are also an excellent emetic. Not only does the emesis relieve the spasm of the laryngeal muscles but if the attack is due to digestive disturbance it relieves the stomach of any irritating contents.

If constipation is present the bowels should be emptied by means of an enema. Further attacks may be prevented by the administration of antipyrine of which a child of two years may receive 2 grains (0.13) every four hours for two or three doses. During the next day the ipecac and tartar emetic may be continued in dosage given above every four hours and the tendency to a paroxysm during the next nights may be combated by giving a dose of antipyrine at bed time. The inhalation of steam from a croup kettle, the child being in a tent made by pinning blankets over its crib, is an excellent means of treating the laryngeal inflammation. To the water in the kettle a drachm (4.0) of compound tincture of benzoin or of oil of eucalyptus or five grains (0.33) of menthol may be added. Hot or cold compresses or poultices of flax seed or very weak mustard may be applied over the larynx with good effect and to relieve the excitability of the patient, 5 to 10 grains of sodium bromide (0.33 to 0.66) may be given.

Patients which resist ordinary treatment may be temporarily intubated.

TUBERCULOUS LARYNGITIS.

Ætiology. This affection may be primary or secondary. Rarely, however, is the former the case since the laryngeal tissues seem not to afford a favorable site for the growth and development of the tubercle bacillus. More frequently is the disease secondary to tuberculous infection of the lungs, bacilli from the sputum finding lodgment and setting up the inflammation. Laryngeal involvement is said to occur in about twenty percent. of instances of pulmonary tuberculosis.

Pathology. The first stage of tuberculous laryngeal inflammation is an anæmia of the tissues due to the occlusion of the blood-vessels of the part consequent upon the growth of new tuberculous tissue. This is followed by a thickening resulting from further growth of and infiltration by this tissue. This infiltration is especially noticeable over the arytenoid cartilages, in the posterior commissure, on the edges of the vocal cords and upon the epiglottis.

The stage of infiltration usually lasts about a week and is followed by ulceration. The ulcers occur in the same situations as the infiltration. They are shallow, their color is that of the surrounding parts with which their edges are flush, there are few signs of acute inflammation and the ulcerating surfaces are covered with a ropy semi-opaque mucus. The final stage of the morbid process is necrosis.

It must be remembered that not all inflammations of the larynx which occur in tuberculous patients are due to the specific infection of the disease.

Symptoms. These are engrafted upon those of the primary inflammation of the lungs if this be present. The first symptom calling attention to the larynx is hoarseness which increases even to entire loss of voice. This is due during the stage of infiltration to the impossibility of approximation of the vocal cords as a result of this condition, later it is due to the ulceration. In this stage the voice is permanently lost and the patient can but whisper. Dysphagia is also a characteristic symptom, though a later one, and does not appear until the ulceration has spread beyond the laryngeal cavity. The pain is often very severe when the swallowing of food is attempted and the patient's state is most pitiable. There are rapid emaciation and loss of strength and the chances for recovery are distinctly not good. In instances where the laryngeal condition is primary the course of the disease is likely to be more rapid than in those secondary to pulmonary disease.

Treatment. The treatment of this condition consists in the employment of all means in our power to sustain the patient and to improve his general condition, just as in pulmonary tuberculosis uncomplicated by laryngeal disease, in the medicinal treatment of the pulmonary lesions (see p. 178) and in the local treatment of the laryngeal lesion. This last consists of thorough cleansing of the laryngeal mucous membrane by means of a spray of an alkaline and antiseptic solution such as the following: ℞ sodii boratis, sodii bicarbonatis, āā ʒi (4.0); glyceriti phenolis, ʒii (8.0); aquæ, ℥viii (250.0), followed by astringent sprays such as zinc chloride 5 grains (0.33) to the ounce (30.0) of water. The inhalation of medicated steam (see p. 624) or of the vapor of 1 to 5 percent. phenol, 1 percent. lysol or 1 percent. creolin solutions may be employed.

The pain may be eased by the inhalation of analgesic powders, or sprays such as morphine acetate 5 to 10 grains (0.33 to 0.66) to the drachm (4.0) of starch; morphine sulphate 5 to 10 grains (0.33 to 0.66) to the ounce (30.0 of water, or morphine hydrochloride 15 grains (1.0), sodium bicarbonate 45 grains (3.0), to 6 ounces (180.0) of water.

When ulceration has taken place the insufflation of morphine sulphate 10 grains (0.66), tannic acid 2 drachms (8.0), iodoform 6 drachms (24.0), or morphine hydrochloride 7½ grains (0.50), iodoform and starch of each 75 grains (5.0), is useful as well as a spray of 20 grains of menthol (1.33), to the drachm

(4.0) of olive oil. To lessen the pain attendant upon the swallowing of food the throat should be anæsthetized, after an alkaline cleansing spray, by a spray of cocaine hydrochloride 5 to 10 grains (0.33 to 0.66), water a half drachm (2.0), to which an ounce (30.0) of albolene is added, or by direct application by means of the laryngeal brush of a 10 to 15 percent. cocaine solution. Such a procedure will bring about an anæsthesia lasting from ten to fifteen minutes during which the patient can eat in comparative comfort.

It is often advisable to feed by means of the stomach tube and forced feeding by gavage often accomplishes excellent results. The food is prepared as follows: Lean meat from which all the tendon and gristle and as much of the fat as is possible have been removed should be used. The meat is to be finely chopped and dried in an oven at 150° F. (66° C.) until it has become absolutely dried. The oven temperature is now raised to 170° F. (77° C.) and the powdered meat allowed to remain for several hours; it is then ground in a mortar and sifted. Six parts of raw meat thus treated will furnish about one part of beef powder.

After cocainization of the throat and larynx the tube is passed, the stomach is washed with a pint (½ litre) of artificial Vichy water and the patient is fed by pouring through the tube ¾ of a pound (312.0) of the beef powder to which three times as much milk has been added. At first such a meal should be given twice a day and the amount gradually increased until the patient takes from 1 to 2 (450.0 to 900.0) pounds of the powder and 4 or 5 pints of milk (2000.0 to 2250.0) per day. If there is difficulty in digesting this the milk may be omitted and a little dilute hydrochloric acid, with sufficient water, added to the meat powder.

Surgical treatment is contraindicated when the pulmonary and laryngeal inflammations are advanced and progressing, it may be employed when the laryngeal disease is quiescent and there is no progressive destruction of tissue or perichondritis. For the technique of the various operations applicable the reader is referred to special works upon the subject.

ŒDEMA OF THE GLOTTIS.

Definition. A submucous serous transudate into the tissues surrounding the laryngeal opening.

Ætiology. This condition may complicate acute or chronic inflammations of the larynx, acute infectious diseases such as typhoid fever or smallpox, or any constitutional condition of which œdema is a feature, notably cardiac and renal disease. The affection may occur at any period of life but is less common in children. The transudation of the serum takes place into the submucosa of the aryteno-epiglottidean folds, of the epiglottis or of the ventric-

ular bands, and may be so marked as to entirely close the superior opening of the larynx.

Œdema of the glottis may also result from the inhalation of irritating vapors or from the swallowing of caustic fluids and rarely from ivy poisoning.

Symptoms. Of these the most prominent is a sensation of oppression, which may be intensified to actual suffocation. The face is anxious, there may be cyanosis of the lips and extremities and there is visible action of the accessory muscles of respiration. The breathing is rapid and stridulous.

Treatment. The milder instances in which the distress is but moderate may be relieved by depletion by means of a hydrogogue cathartic such as magnesium sulphate or citrate and the inhalation of steam which may be medicated by the addition of a little compound tincture of benzoin or menthol. Astringent sprays such as alum 1 part, to 24 of water, or alumnol 1 to 1½ parts to 24 of water may be employed. Leeches or blisters over the larynx may relieve the milder degrees of this condition. Cold applied in the form of compresses to the neck or by means of ice bags or coils is an excellent remedy and it may be applied internally as well, by giving the patient pieces of ice to hold in the mouth. Pilocarpine in dosage of ¼ of a grain (0.016) given hypodermatically is said to have achieved excellent results but the drug should be used with caution especially if the heart tends toward weakness, since it may bring about œdema of the lungs.

Hot packs may be given but unless the therapeutic methods above described succeed in ameliorating the condition, scarification of the infiltrated tissue will will usually be found necessary. In the markedly acute instances in which the patient is *in extremis* from the first the physician should be prepared to perform intubation or tracheotomy, preferably the former, at a moment's notice.

DISEASES OF THE TRACHEA AND BRONCHI.

ACUTE BRONCHITIS.

Synonyms. Acute Bronchial Catarrh; Acute Catarrhal Bronchitis.

Definition. An acute inflammation of the mucous membrane of the trachea and bronchi usually accompanied by cough and more or less expectoration.

Ætiology. This disease is most common in cold and damp climates and in the winter months. Dwellers in cities seem to be more prone to bronchitis than those living in the country. Some persons appear to have a predisposition to attacks of the disease. Exposure to cold and dampness, the breathing of irritating fumes, dust, and of certain toxic bacteria may be classed as exciting causes. Frequently the affection follows an acute cold in the head, the inflammation extending downward from the upper air passages to the

trachea and bronchi. It often occurs as a complication of the infectious diseases, especially measles, influenza, typhoid fever, etc.

Pathology. The mucous membrane lining the trachea and larger bronchi —more rarely that lining the smaller bronchi—is hyperæmic and swollen. At first the secretion of mucus is diminished, later it is increased and a tough exudate covers the bronchial mucous membrane. There are desquamation of the epithelial cells lining the bronchi, emigration of leucocytes and diapedesis of red cells. If the inflammation continues, a round celled infiltration occurs in the peri-bronchial tissue, which may be termed a peri-bronchitis and is likely to result in a permanent pathological condition, a fibroid phthisis or chronic interstitial pneumonia, the latter term being preferable.

Symptoms. The severer instances may be ushered in by a chill followed by a rise in temperature which may continue throughout the course of the disease. Usually the fever is not above 101° F. (38.5° C.) but it may rarely reach a height of 103° F. (39.5° C.) to 104° F. (40.0° C.). The pulse rate is moderately increased and the respiration may be accelerated. There may be dyspnœa of varying degree due to the decrease in the calibre of the bronchi resulting from the swelling of their linings and from the exudation of mucus. There is cough, at first dry, later with mucoid or muco-purulent sputum, which rarely may contain a little blood. There may be pain in the chest. The disease usually lasts from four or five days to two weeks, the cough, sputum and other symptoms gradually disappearing, but at times a longer course occurs.

Physical Signs. These depend upon the degree and stage of the inflammation. In the milder instances, no physical signs whatever may be obtainable. In those of more severe type, the respiration may be accelerated. The *percussion* note remains unchanged.

On *auscultation* sibilant and sonorous, coarse and subcrepitant râles in varying number are heard, the voice as a rule, remaining unchanged. If the condition passes on to one of chronic interstitial pneumonia the elasticity of the lung is diminished and a prolonged inspiratory and expiratory murmur, with increased intensity of the former and of the vocal resonance, may be detected.

Prophylaxis. Patients subject to frequent attacks of acute bronchitis may, in great measure, prevent their occurrence by means tending toward a properly hygienic mode of life. Patients in the acute stage of the disease should be confined to their rooms but it is important to see that the rooms are well ventilated and that the air contains the proper amount of moisture. An instrument called the psychrometer may be used to determine the quantity of moisture, which should be about 70 percent., in the atmosphere of the apartment and the regulation of the moisture may be accomplished by ventilation if it is too great or by sprays of water or by means of evaporation from

water contained in open vessels if it be too small. After the acuity of the attack is over the patient, especially if there be any predisposition to the disease, may be advised to seek a mild climate. Certain patients do well in sea air, others do better inland. The salt in the sea air has no especial influence but the atmosphere near the ocean, owing to its large content of moisture and the fact that it is seldom at rest, is especially beneficial to many patients. Such resorts as Lakewood and Atlantic City may be suggested.

Hardening processes, especially among the more enlightened classes are coming more and more into vogue, and rightly so when they are properly carried out; a morning bath beginning at from 90° to 95° F. (31° to 35° C.) and gradually lowered, taking into consideration the season and the reaction of the patient, is often of considerable benefit in this connection.

The clothing is an important consideration and should be adapted to the condition of the weather. In a changeable climate in order to be properly clothed one must often vary the weight of the underclothing from day to day; warm garments of light weight are always to be preferred.

As far as diet is concerned it is difficult to make hard and fast rules. The digestion of the patient must be considered and food easily digested and assimilated and at the same time nourishing should be prescribed. Cod-liver oil, when well borne, is often beneficial.

Many patients will be found for whom a change of climate is impossible. These should be warned against mouth breathing and instructed in the proper ventilation of their living and sleeping rooms. Persons whose occupations compel them to spend considerable periods in an atmosphere contaminated by dust may wear respirators.

Treatment. During the febrile stage of the disease it is best to confine the patient to bed in a well ventilated room. The diet should be light and easily digestible.

The object of our treatment should be to cure the inflammation as quickly as possible in order that the condition may not go on and result in a chronic interstitial pneumonia. Early in the disease when the sputum is scanty and difficult to raise an expectorant is indicated. Of this class of drugs probably the most active which we possess is apomorphine hydrochloride; its expectorant dose is about $\frac{1}{32}$ of a grain (0.002) and if the drug is pure no emetic effect need be feared. In twenty minutes after its administration, in a chest where none were previously heard, numerous coarse and fine râles may be detected and the patient will begin to expectorate watery sputum in profuse quantity. The apomorphine may be prescribed as follows: ℞ apomorphinæ hydrochloridi, gr. ss (0.03); sodii bromidi, ʒiii (12.0); tincturæ sanguinariæ, ʒss (15.0); syrupi tolutani, ʒii (60.0). Misce et signa 1 teaspoonful (4.0) in a wineglass (60.0) of water every two hours. This prescription is not applicable in senile bronchitis nor in the bronchitis of children

save in very small doses. Under this treatment if the patient is seen on the first day of his bronchitis he should be well within three or four days.

If the patient does not consult the physician until the bronchitis is advanced and the secretion thick and muco-purulent the following formula will be found useful. ℞ fluidextracti cocillanæ, ℥ss (15.0); fluidextracti lippiæ Mexicanæ, ℥i (30.0). Misce et signa ½ teaspoonful (2.0) in a wineglass (60.0) of water every two hours. Cocillana is in this dosage a pure expectorant and stimulates markedly the muciparous glands of the bronchi. In the later stages of the disease it is wise to give the patient night and morning a glass of hot milk containing a little whiskey or brandy, and follow this by a dose of either of the above mixtures. This procedure will result in a thorough clearing out of the accumulations of secretion in the bronchi.

The drinking of considerable quantities of ordinary or of mineral water will increase the bronchial secretion and render a viscid mucus easier of expectoration.

Numerous expectorant drugs in addition to those above mentioned may be used with good effect. Of these perhaps the two most frequently employed are ipecac which may be given in powdered form or as the wine, and ammonium chloride. The following is an excellent formula: ℞ ammonii chloridi, ℥ss (15.0); extracti glycyrrhizæ, ℥ss (15.0); fluidextracti eucalypti, ℥i (30.0); syrupi eriodictyon, q.s. ad ℥iv (120.0). Misce et signa 1 teaspoonful (4.0) in water every four hours. Hydrocyanic acid and the balsams may be found effectual.

In preparing cough mixtures the use of syrups should be avoided if the prescription is to be continued for any long period, since these are very prone to cause gastric fermentation.

When the cough is distressing to the patient and prevents sleep relief may be obtained by administering heroine in doses of $\frac{1}{24}$ (0.0027) of a grain, or codeine, ⅛ of a grain (0.008) every four hours until relieved. It is seldom necessary to use opium or morphine in this connection.

Inhalations from an inhaler, of which there are various forms, of the vapor of water, plain or to which sodium chloride (1 to 128), compound tincture of benzoin (1 to 128), creosote (1 to 1,500), fluid extract of belladonna (1 to 252), a little turpentine or one of the various tar preparations has been added may serve to loosen the bronchial secretion and lessen the frequency of the cough. These inhalations are especially useful in children to whom they may be given from a croup kettle, the steam of which is passed into a tent formed of blankets and arranged over the patient.

Local applications frequently serve to ease the pain in the chest, and in the opinion of some observers, certain forms of local application, notably the Priessnitz *Umschlag*, which consists of a compress of flannel, large enough to envelop the entire chest, wrung out of water as hot as the patient can

endure, quickly applied, covered with oiled silk and renewed when cold or as often as seems good to the physician, have a decided curative effect. Cold packs, rubs and douches may also be used.

Other applications which may be mentioned are mild sinapisms, painting with tincture of iodine, kaolin poultices, compresses spread with vaseline over which a few drops of turpentine have been sprinkled, and various liniments.

CHRONIC BRONCHITIS.

Synonyms. Chronic Catarrh of the Bronchi; Chronic Catarrhal Bronchitis.

Definition. A chronic inflammation of the mucous membrane lining the bronchi.

Ætiology. Chronic bronchitis may rarely be a primary inflammation, but it is more usually a result of repeated attacks of acute bronchitis. It also is a frequent complication of pulmonary tuberculosis, pulmonary emphysema, chronic endocarditis and nephritis, and may be due to the continued inhalation of irritating substances such as stone or coal dust.

Pathology. The mucous glands of the bronchi may be hypertrophied; the bronchial lining is coated with a viscid grayish secretion which contains desquamated epithelial cells and sometimes blood; the walls of the bronchi may be congested and they may be either thicker or thinner than normal. The calibre of the bronchi may be increased, especially in old patients in whom there may be sacculated or fusiform dilatation of the tubes, or it may be diminished as a result of the increased secretion. The walls of the bronchi in advanced instances may be ulcerated or necrotic.

Symptoms. Cough with expectoration is the most characteristic symptom of this disease and in milder instances it may be the only one. The cough is more or less troublesome, depending upon the degree of the inflammation. It is frequently most marked at night and in the morning and at times may occur in paroxysms which are relieved by the ridding the bronchi of a considerable quantity of sputum. The sputum may be thin and mucoid or thick and purulent, in which case it varies from yellow to greenish in color. It contains pus cells, epithelial cells, various kinds of bacteria, mucus and at times red blood cells in varying number.

Rise in temperature is not a characteristic feature of this disease but in long standing instances in weakened individuals there may be a slight febrile movement (100°–101° F.—37.6°–38.3° C.) due probably to absorption of septic products. The lack of temperature elevation is a useful point in the differential diagnosis from pulmonary tuberculosis.

The heart action in chronic bronchitis is likely to be uninfluenced to any great degree by the disease itself, further than to be slightly accelerated; especially is this apt to be the case in patients who exhibit fever. The cardiac

action is, however, usually affected by the frequently co-existing morbid processes in the arteries, kidneys and the heart itself.

The respiration may be more rapid than normal but dyspnœa is not a feature of the disease unless complications such as emphysema are present.

Early in the disease the general condition is but slightly affected but as time goes on the appetite and digestion become impaired and there is consequent loss of flesh.

Fœtid or *putrid bronchitis* in which the sputum has a characteristic foul odor due to the action of the bacteria of decomposition, may follow the ordinary type of the disease; rarely is it primary. Here the characteristic odor of the sputum and the fact that upon standing it forms distinct strata, the upper thin, frothy and muco-purulent, the lower thicker, purulent and containing grayish bits of matter of about the size of a pea and which the microscope shows to consist of pus, fat crystals, fungi and bacteria of various sorts, are diagnostic points.

In this form of bronchitis there is usually a febrile movement, at times of septic type, in which event chills are often a feature. Putrid bronchitis is a severe variety of the disease and during its course metastatic purulent processes may be set up in different parts of the body.

Patients affected with chronic bronchitis are usually better in summer and worse in winter. The disease is of long course but seldom of itself fatal. Unfortunately, however, the prognosis as to complete recovery is not favorable. Emphysema is a frequent co-existent condition.

Physical Signs. Inspection may reveal little except when there is complicating emphysema, in which case we find the characteristic barrel-shaped thorax and the diminished respiratory excursion. Upon *palpation* the hand may detect the presence of ronchi. The *percussion* note may remain unchanged or be hyper-resonant or tympanitic in emphysematous patients, and over a dilated tube containing excessive secretion it may be dull. In this last case free expectoration may result in a return to normal resonance. *Auscultation* may reveal nothing abnormal but usually the respiratory murmur is diminished in intensity or is harsh and numerous sibilant, sonorous and moist râles are distinctly heard.

Treatment. The treatment of chronic bronchitis is practically that of the prolonged type of acute bronchitis. Respiratory exercises, thoracic massage, proper hygiene and removal to a high, dry inland climate, the temperature of which is of slight importance and may be left to the choice of the patient, during the winter months, are strongly to be recommended. The diet should be of easily digestible foods and of good quantity. Moderate open air exercise and mild hydrotherapeutic procedures may be prescribed and courses of treatment at watering places are often attended with good results.

A point often overlooked is the possibility that the bronchitis may be due to or accentuated by lesions of the upper air passages; consequently these should be examined and, if necessary, operative interference advised.

Patients with complicating circulatory disturbances or chronic nephritis are likely to need cardiac stimulants or vaso-dilators, together with general tonics.

Co-existent emphysema should be treated according to the principles laid down in the section upon this subject.

Of the numerous drugs employed in chronic bronchitis perhaps creosote is the one upon which the greatest dependence may be placed. Its greatest disadvantage is its tendency to disturb digestion but when properly administered or given by inhalation this fault may be avoided. In bronchitis, especially of the fœtid type, the use of Robinson's inhaler with the sponge moistened with a mixture of equal parts of alcohol, chloroform and beechwood creosote is often of great benefit. The apparatus should be worn as continuously as possible and after he has become accustomed to it the inconvenience which it causes the patient is small.

Creosote may be given internally, combined with nux vomica which is an expectorant of considerable value, in the following formula: ℞ Creosoti, ℥ii (8.0); tincturæ nucis vomicæ, ℥ss (15.0); tincturæ gentianæ compositæ, q.s. ad ℥iv (120.0). Misce et signa 1 teaspoonful (4.0) after each meal.

Creosote carbonate may be substituted with advantage for creosote. This drug is less disturbing to the stomach and less unpleasant to take. Its dose is from 10 to 20 minims (0.66 to 1.33) three times a day and may be rapidly increased to half an ounce (15.0) per day.

The derivatives of turpentine, terpene hydrate, grains 2 to 10 (0.13 to 0.66) and terebene, minims 3 to 10 (0.2 to 0.66) are often found useful as is potassium iodide, the last being especially indicated in cases with scanty and tenacious sputum.

When a stimulating expectorant is needed ammonium chloride in the following combination may be employed: ℞ ammonii chloridi, ℥ss (15.0); extracti glycyrrhizæ, ℥ss (15.0); fluidextracti eucalypti, ℥i (30.0); syrupi eriodctyon q.s. ad ℥iv (120.0). Misce et signa 1 teaspoonful (4.0) in water every four hours.

Distressing cough may be relieved by heroine, grains $\frac{1}{20}$ (0.003) or codeine grains $\frac{1}{10}$ (0.006) and the inhalations recommended on p. 633 may be found useful.

FIBRINOUS BRONCHITIS.

Synonym. Plastic Bronchitis.

Definition. A rare variety of bronchial inflammation, usually chronic, during the course of which fibrinous casts of the bronchial system are formed

and expectorated. This affection has no connection with croupous or diphtheritic conditions in which casts of the air passages sometimes occur.

Ætiology. This disease is often associated with pulmonary tuberculosis. It affects males more than females and, while it may occur at any age, is somewhat more frequent during adolescence and early adult life. It is at times associated with other diseases but this seems to be coincidence rather than direct relation.

Pathology. Little is known of the morbid anatomy of this condition. From time to time tough, pulpy, yellowish-white material is expectorated, which, when carefully teased or put into water is seen to be a hollow cast of a bronchial trunk and its branches. This is composed of fibrin and leucocytes and may contain Charcot-Leyden crystals and Curschmann's spirals. The bronchi from which the cast has come have lost their epithelial lining and there may be congestion and infiltration of their submucous coat.

Symptoms. These resemble the symptoms of a marked bronchitis, with cough and dyspnœa, pain in the side, and in acute instances, a febrile movement. The sputum is scanty until the cast becomes loosened and is expelled. Rarely preceding this circumstance blood may be expectorated; hæmoptysis, usually slight, is less infrequent after expectoration of the cast. When this last has taken place the symptoms become ameliorated and recovery may ensue. More usually, however, the symptoms recur after a number of hours or a few days and another cast is expectorated, to be followed at intervals, in certain patients, by several more. When an attack has terminated no recurrence may take place or the patient may experience a number of subsequent ones. The disease is very seldom fatal although the symptoms of a severe instance may be alarming.

The physical signs are those of bronchitis. As the casts become loosened, over the tubes in which they are located, mucous râles may be audible.

Treatment. The diagnosis is seldom made before the appearance of a bronchial cast, consequently the treatment is usually that of simple bronchitis. When the diagnosis is made, relief may be experienced from the inhalation of steam, of the vapor of lime water or other alkaline solution, e.g., sodium bicarbonate ℥ss (2.0) to the ounce (30.0) of water, or the use of laryngeal sprays of similar solutions.

The administration of mercury has been recommended and potassium iodide, especially in protracted instances, should have a field of usefulness.

Other drugs which have been used in the treatment of this condition are atropine, belladonna, turpentine, tar and creosote.

When the lesion is the result of streptococcus infection the injection of antistreptococcus serum is indicated but by no means all instances are due to infection by this organism.

The general treatment, dietetic, hygienic, etc., is identical with that of ordi-

nary bronchitis; change of climate to one where the atmosphere is dry and bronchial inflammations are rare will usually be of benefit.

SPASMODIC BRONCHITIS.

Synonym. Bronchial Asthma.

Definition. Spasmodic bronchitis is a paroxysmal dyspnœa due to a contraction of the muscular tissue in the walls of the bronchi.

Ætiology. Chronic bronchitis and emphysema are the chief predisposing causes of this disease, but attacks of asthma may occur without any apparent pulmonary lesion. The predisposition to asthma is a feature in some families and here it is probably the result of a highly organized and easily excitable reflex nervous system. Pharyngeal and intra-nasal lesions, such as polypi, deflected septa, adenoid vegetations, etc., should always be thought of in connection with this disease.

Attacks of asthma may be excited by the inhalation of ordinary dust, irritating vapors, the pollens or odors of various plants, or of any foreign substance. Certain climates or changes in the weather may bring on paroxysms, and attacks may occur without any assignable cause. Neurotic persons are most likely to suffer from the disease and it is probable that the various influences which bring about asthmatic attacks act in some way upon a hyperexcitable reflex center. Asthma may occur at any age and is more common in males.

Pathology. Asthma *per se* has no pathology. The changes found in the lungs of asthmatic patients are those regularly existing in chronic bronchitis and emphysema.

Symptoms. Between the attacks the patient is apparently in good health unless there is co-existent pulmonary disease, in which case his symptoms are those of the existing condition. The asthmatic paroxysm may occur without warning—usually in the night—or there may be prodromal symptoms such as a sensation of oppression about the chest, or a feeling of restlessness or anxiety. As the attack comes on the feeling of suffocation increases, the patient must sit up or stand in order to breathe more easily and the accessory muscles of respiration come into play. The expression is anxious and the skin may be livid or cyanotic. The pulse is rapid and feeble, but the respiration is seldom more than slightly accelerated. There is no rise of temperature. The noise made by the entrance and exit of air into and from the chest may be audible at some distance from the patient.

Such a paroxysm may last from an hour or two to several days, but sooner or later terminates. It may subside suddenly or gradually. At times the end of an attack takes place with a fit of coughing.

Cough is not a feature of this disease and may be entirely absent during

the attacks, especially if they be mild. The more marked attacks may be accompanied by cough with scanty sputum of viscid muco-pus containing the typical Charcot-Leyden crystals, Curschmann's "spirals" and Laennec's "perles." Calcium oxalate and phosphate crystals may also be present.

Asthma is a chronic but not a fatal disease. Certain patients tend, as they grow older, to have attacks with less frequency and in others the opposite of this statement is true. Cure may be brought about in many patients by a removal of the cause of the condition or by change of climate. The condition of the nose and naso-pharynx of all asthmatics should be carefully examined.

Physical Signs. In the intervals of the attacks the physical signs are those of the co-existing pulmonary condition. During the paroxysm they are these plus the typical signs of an asthmatic attack which are as follows: *Inspection* reveals rapid respiration carried on with much effort but with little movement of the thorax; there is retraction of the supra- and infra-clavicular, and intercostal spaces, as well as of the abdomen. *Palpation* reveals a ronchal fremitus which may obscure that of the voice. *Percussion* is normal unless there is a co-existent emphysema. *Auscultation.* Over both chests sonorous and sibilant breathing so marked in character as, at times, to be perceptible without approximating the ear to the thorax, is heard. So typical is this breathing that, once it has been heard, no difficulty in recognizing it will be experienced. As the attack subsides moist râles become audible, and the sibilant and sonorous sounds diminish.

Treatment consists in (a) the attempt to cut short the attack and in (b) the prevention of subsequent paroxysms. The best means of accomplishing the former object is for the patient to inhale the vapor of ethyl iodide. He may carry with him a glass-stoppered vial containing a small quantity of this agent, for use when necessary. Its great disadvantage is its vile odor which makes it very disagreeable to the patient's associates. Ethyl iodide in 10 minim (0.66) capsules taken every four hours is also very effective but causes disagreeable eructations.

The inhalation of a few drops of amyl nitrite or of the fumes of the various so-called asthma powders, which usually contain belladonna or stramonium leaves and potassium nitrate, may afford relief. Asthma powders must be used with care and their fumes inhaled only in thoroughly ventilated places. The following formula may be found useful: ℞ stramonii foliorum, potassii nitratis āā ℥i (30.0); belladonnæ foliorum, cannabis indicæ foliorum āā ℥ss (15.0). Misce. A tablespoonful (15.0) of this powder may be burned upon a dish and the smoke inhaled. Cigarettes made from belladonna or stramonium leaves soaked in a solution of saltpetre and then dried may be smoked with good effect. Wrapping these cigarettes in paper impregnated with arsenic may add to their potency. The fumes of paper treated with saltpetre when inhaled will sometimes cut short an attack.

Hypnotics such as morphine, hydrated chloral or hyoscine hydrobromate are recommended by certain authorities but these should be employed with greatest caution. They are usually given hypodermatically and in ordinary dosage. Tincture of lobelia—m v to viii (0.33 to 0.50) every half hour until two or three doses have been taken—chloralformamide and scopolamine hydrobromide—gr. $\frac{1}{200}$ (0.0003) hypodermatically—and atropine sulphate may be employed.

A simple and sometimes an effective means of treatment during an attack is a hot foot bath; and in this connection it is well to mention the fact that some patients experience much relief from simple inhalations of steam.

Heroine by some observers has been found useful during the paroxysm and may be given hypodermatically in doses of $\frac{1}{100}$ grain (0.006) every hour during the attack and by mouth after the severity of the paroxysm is over. It must be remembered that this drug is a morphine derivative and must be cautiously used. The same may be said of codeine in this connection.

Dionine (morphine ethyl chloride) given hypodermatically, gr. $\frac{1}{200}$ to $\frac{1}{4}$ (0.003 to 0.016) is highly recommended for use during the asthmatic attack. It is said to be as efficacious as morphine and is preferable to that drug since no habit is likely to be induced.

The warding off of subsequent paroxysms is to be accomplished by:

1. *Drug Medication.* This consists principally of the treatment of the co-existent chronic bronchitis (see treatment of chronic bronchitis, p. 635) with certain additions. Iodine, given in the form of the syrup of hydriodic acid, ℥i (4.0) in a wineglass (60.0) of water half an hour before each meal, should always be tried.

Arsenic in the form of arsenic trioxide—$\frac{1}{200}$ (0.003) of a grain after meals—or Fowler's solution—2 to 8 drops (0.13 to 0.50)—may act well and the arseniated mineral waters may be prescribed.

Sodium iodide—5 to 15 grains (0.33 to 1.00) dissolved in water—atropine, $\frac{1}{200}$ of a grain (0.0003), and nux vomica in increasing doses are drugs which may be employed in the intervals of the attacks.

2. *Hydrotherapy.* Douches and hot packs act well upon some patients. The latter are given as follows: The patient is wrapped in a sheet wrung out in as hot water as he can endure, over this is wrapped a blanket, and in these the patient remains for one hour.

3. *Hygienic and Climatic Treatment.*

It is unnecessary to suggest that tobacco and alcohol are, in most instances, to be forbidden and that the patient should lead a quiet, regular life and one as far as possible in accordance with hygienic principles. The diet is often an important consideration; the digestion should be treated, if necessary. The food should be easily digestible, nourishing, and taken regularly. The lighter meats such as fowl, steak, chops, etc., and fish are allowable and the green

vegetables and potatoes may be eaten. Highly seasoned dishes, rich pastry and fried foods are better omitted. It is better that the heaviest meal come in the middle of the day, the supper should be simple and the patient should retire on an empty stomach. Tea and coffee in moderation may be taken.

When all is said, however, the physician will probably find it necessary to study the diet of each patient separately and learn what is and what is not well borne.

With regard to climate also, each patient is likely to be found a law unto himself and it may be necessary to do some experimentation before a suitable resort can be found.

The only hard and fast statement that it is possible to make is that an asthmatic patient should reside where he has the least number of paroxysms, and it may be found necessary to change the residence with the seasons of the year. Some do well in the high regions of Colorado, others in the warmer climates of California or the southern states, while the White Mountains, Lakewood, or the woods of the Adirondacks or Maine will be found to suit still others.

When change of climate is impossible, as is often the case, the physician will be surprised to see how much benefit may accrue from insistence that the patient be in the fresh air as much as possible and that he sleep in a thoroughly ventilated room no matter what the weather may be.

BRONCHIECTASIS.

Synonym. Bronchial Dilatation.

Definition. A dilatation of the bronchial tubes.

Ætiology. Bronchiectasis is usually the result of a chronic bronchitis which has so weakened the walls of the bronchi that the strain put upon them in the effort of coughing causes them to dilate. It is frequently found in emphysema and may exist in children as a sequela of whooping cough or broncho-pneumonia. A bronchiectatic cavity may be caused by the pressure of bronchial secretion retained behind an obstruction due to a foreign body or pressure resulting from a new growth or aneurysm. Dilatations of the bronchi may also result from the contraction of new growths of fibrous tissue in the substance of the lung or of chronic pleuritic thickenings. These in their contractions may so pull upon and distort the bronchi as to produce dilatations or stenoses. Congenital bronchiectases have been described.

Pathology. Two forms of bronchiectatic cavities may occur—cylindrical and sacculated, and both may exist in the same patient. Cylindrical bronchiectases are more often seen affecting the smaller bronchi, but they may be observed in the larger tubes.

The saccular bronchiectasis occurs as a spherical or ovoid enlargement

of a bronchial tube. These dilatations are usually surrounded by compressed and indurated lung, the contraction of this tissue having resulted in the bronchiectatic cavity. Pleuritic adhesions by their contraction may also produce bronchial dilatations, these usually being found at the pulmonary bases. Tuberculous cavities oftentimes have their beginnings in bronchiectases. The dilated wall of a bronchiectatic cavity is thinned and atrophied, this atrophy at times affecting its mucous lining, its muscular coat and even its fibrous and cartilaginous envelope. The normal lining of ciliated epithelium becomes converted into pavement cells. Ulcerations of the walls of the cavity which may perforate into the surrounding pulmonary tissue may occur, and there may be connective tissue proliferation which takes the form of projections into the lumen of the dilatation.

Symptoms. The most prominent symptom is cough. This is frequently most severe in the morning, continuing until the bronchiectases have gotten rid of the accumulated sputum of the night. At first the cough may be unproductive, then suddenly, a copious expectoration taking place, it may cease entirely until a reaccumulation of secretion has occurred, when the patient will suffer another paroxysm. The paroxysmal cough followed by copious expectoration is characteristic of this condition. The sputum is usually typical. It is often raised by the mouthful and consists of a dull yellow-green, unpleasantly sweet smelling muco-pus. In odor it is less fœtid than the sputum of fœtid bronchitis. On standing it separates into three layers. Of these the uppermost is of thin froth, the middle is mucoid and the lowermost consists of purulent material with which are mixed degenerated epithelial cells, granular matter, fatty acid and hæmatoidin crystals and sometimes red blood cells. Tubercle bacilli may be present if there is co-existent tuberculous infection.

A febrile movement is rarely present unless there is complicating tuberculosis or pyæmic infection.

The course of the disease depends upon the presence or absence of the above-named infections and upon the patient's general condition. While the changes in the lung are usually permanent they are by no means prejudicial to the continuance of life. A spontaneous recovery has been known to take place as a result of an obliteration due to connective tissue growth.

Physical Signs. Small bronchiectases may not be demonstrable during life; larger ones when near the surface present the usual signs of a pulmonary cavity. The percussion note is flat, tympanitic or cracked pot; the breathing may be bronchial or amphoric; the voice bronchial or ægophonous. Pectoriloquy may be present. If the cavity contains fluid, gurgling râles may be audible. The vocal fremitus is often accentuated as a result of the surrounding pulmonary induration. Great variations in physical signs are frequent, depending upon the presence or absence of fluid within the cavity.

Treatment. Proper hygiene such as that suggested in the treatment of emphysema and chronic bronchitis is absolutely necessary. The patient should avoid too damp and cold climates and seek those of mild temperature. Air too dry, and high altitudes are not likely to benefit the sufferer. The seaside, when not too damp, is permissible. The patient must be warned against exposure and should be advised to wear woolen underclothing the year round.

Under proper precautions, a life in the open air in a proper climate is to be recommended.

The expectoration of the accumulations of sputum may be facilitated and the cough relieved by lowering the head of the patient. This may be accomplished by directing him to stoop or, if he is confined to bed, by raising the foot of the bed ten or twelve inches.

With regard to drug treatment our primary object must be to maintain an aseptic condition of the cavities. The inhalation of vapors of creosote (see p. 636) and turpentine may accomplish something toward this end. Eucalyptus in either of the following formulæ may be employed: ℞ tincturæ eucalypti, ℥ss (15.0); olei lavandulæ, ♏ v (0.33). Misce et signa—10 drops (0.66) in a pint (500.0) of boiling water and inhale the steam. ℞ eucalyptolis, ♏ lxxv, (5.0); spiritus lavandulæ, ℥v)20.0). Misce et signa—10 to 20 drops (0.66 to 1.33) in a pint (500.0) of boiling water and inhale the steam. Inhalations of one to four percent. phenol and of one-half percent. solutions of thymol have been recommended.

The most satisfactory inhalation is probably that of the vapor of creosote and is carried out as follows:

The patient is placed in a small room from which hangings and furniture, except plain wooden articles, have been removed. He should be dressed in a voluminous gown to prevent the odor of the creosote from penetrating his clothing, his eyes should be protected by automobile goggles or an appliance made of watch crystals and adhesive plaster and his nostrils plugged with cotton. Creosote in a metal vessel is heated over an alcohol lamp or Bunsen burner. The vapor of the creosote will cause the patient to cough and expectorate profusely. While unpleasant at first, this procedure soon becomes tolerable and the length of the *séance* may be increased from a quarter of an hour every two days to an hour or more every day. The persistent use of this treatment is said to accomplish excellent results.

The internal administration of medicaments calculated to render aseptic the bronchial passages is likely to be more effective than are the attempts to accomplish this end by inhalations. Creosote, oil of turpentine in the usual doses or terpene hydrate, 5 grains (0.33) three times a day may be employed. Phenol may be given in the following formula but must be stopped if any darkening of the color of the urine is observed. ℞ phenolis, gr. viiss (0.5);

aquæ destillatae, ℥vss (165.0); aquæ menthæ piperitæ ℥iiss (10.0). Misce et signa one tablespoonful (15.0) every three hours.

Myrtol is said to diminish the fœtor of the expectoration. It may be given in capsules in doses up to a drachm and a half (6.0) per day.

Eucalyptus in the form of eucalyptol—15 to 30 drops (1.0 to 2.0) per day in capsules—or in the following formula may be prescribed: ℞ tincturæ eucalypti, ♏ xlv (3.00); aquæ destillatæ, ℥vss (22.0); syrupi aurantii, ℥iiiss (14.0). Misce et signa one tablespoonful (15.0) every two hours.

Sodium subsulphate, one drachm (4.0) daily in divided doses either unmixed or in combination with eucalyptus, may be employed.

Expectorants may be used temporarily when for any reason it is suspected that there is retention of the bronchial secretion. Of these the most satisfactory are apomorphine, ipecac, and ammonium chloride. Ammonium iodide may benefit certain cases.

Attempts to reach and disinfect the cavities by direct injections of antiseptic fluids have been made but are probably useless on account of the impossibility of reaching the situation of the lesion.

Hypodermatic injections of guaiacol or creosote in sterile olive oil have been suggested. A half drachm (2.0) of a twenty-five percent. solution of either of these substances may be given.

Chopped garlic—4 drachms (15.0) daily in divided doses—and oil of allyl, ½ a minim (0.03) are said to favorably influence this disease, to better the general condition and to lessen the fœtor of the sputum. Both these substances are best given in capsules.

Intra-tracheal injections have been strongly recommended in the treatment of this condition but their employment, especially in tuberculous cases, is hardly to be advised. The medicament used is generally some combination such as the following: Guaiacol 2, menthol 10, olive oil 88.

The inhalation of oxygen is of little practical value.

Surgical treatment, consisting of the opening of the bronchiectatic cavity and the evacuation of its contents, may be indicated if we are certain of the locality of the lesion, this having been established by preliminary puncture by an exploring needle. On the other hand the many difficulties and dangers of pulmonary surgery and the fact that bronchiectatic cavities are seldom single should render us loath to recommend surgical intervention without the most careful consideration.

DISEASES OF THE LUNGS.

PULMONARY EMPHYSEMA.

Emphysema of the lungs occurs in two principal forms: *a. Interlobular or interstitial emphysema* which is the result of rupture of the walls of the

air cells and an accumulation of air in the interlobular tissues. This variety may be due to wounds of the lungs or to any violent effort during which a considerable volume of air is suddenly introduced into the lungs, as in whooping or other violent paroxysmal cough, muscular exertion in lifting, etc. This variety of emphysema is difficult of diagnosis unless the air released from the lungs reaches in some way the subcutaneous tissues of the neck or chest. In such instances the existence of crepitation like that obtainable in surgical emphysema renders the condition capable of demonstration.

b. Vesicular emphysema may be subdivided into (1) true vesicular emphysema which is a condition characterized by an increase in the capacity of the air vesicles followed by an atrophy of their walls, the blood-vessels of which may be obliterated; (2) compensatory emphysema which results from the attempt on the part of the organ or a portion of it to do the work of a diseased portion of the same or the other lung; (3) senile or atrophic emphysema in which a shrinkage of the chest and the lungs takes place. There is a decrease in the size of the air spaces and the condition is one of senile atrophy.

From a clinical standpoint only true vesicular emphysema need be dealt with.

Ætiology. This disease is usually the result of a long standing chronic bronchitis, which may date back even to childhood. In certain families there seems to be a hereditary predisposition to the condition, and while it is essentially a disease of advanced life, it is by no means unknown in young persons and even in children.

Persons subject to asthmatic attacks, players upon wind instruments, glass blowers and those who work in dusty or contaminated atmospheres are prone to the disease, and singing and public-speaking are also considered predisposing causes.

The statement that emphysema and pulmonary tuberculosis do not co-exist is without foundation.

Pathology. The costal cartilages are usually ossified and the lungs of greater than normal volume; elevations upon the surfaces of these organs due to dilatations of the air spaces may be visible to the naked eye. The lungs do not as a rule collapse upon removal from the thorax. Microscopic examination shows that the walls of some of the air spaces are thinner than normal, while those of others are increased in thickness; certain air spaces will be found to communicate with others by means of openings in the pulmonary tissue dividing them. The connective tissue framework of the lungs is hypertrophied, and the appearance of the bronchi is that of chronic bronchitis (*q. v.*). In marked instances of emphysema there are, as a rule, co-existent connective tissue inflammations of other organs and tissues such as the kidneys, liver, arteries and heart muscle. There frequently is hypertrophy of the

right ventricle of the heart due to the fact that the pulmonary inflammation has rendered greater force necessary to drive the blood through the lungs.

Symptoms. The onset and progress of the disease are gradual and it may exist for a number of years without causing noticeable symptoms. Usually an increasing dyspnœa on exertion is the first manifestation which attracts the patient's attention. This may vary from a mere inconvenience to a distressing shortness of breath. There may be attacks of spasmodic asthma due either to contraction of the bronchial musculature or of the arteries.

There is usually more or less cough with muco-purulent and sometimes blood stained sputum. This symptom is due to the associated chronic bronchitis, is more marked in the cold months and may be almost entirely absent in summer. Cyanosis may occur as a result of diminished aëration of the blood.

The excess of work thrown upon the right heart may result in various œdematous conditions, and in certain patients the symptoms of the concomitant kidney, cardiac or arterial lesions entirely overwhelm those of the emphysema and this last escapes wholly unnoticed.

There is seldom a febrile movement; pulse rate is, as a rule, accelerated.

The disease tends to progress, but its symptoms may be greatly relieved by proper treatment; it seldom results fatally.

Physical Signs. Inspection. The thorax is vertically lengthened giving the typical "barrel-shaped" appearance to the chest. The respiratory movement is slight.

Palpation. Vocal fremitus is lessened. The cardiac apex beat may be displaced toward the right by the pressure of the distended lung.

Percussion. The note is usually hyper-resonant in marked instances, although it often remains unchanged. In quality it may be either dull and wooden or tympanitic in varying degree. Cardiac dulness is likely to be diminished in area and the dulness due to the upper limit of the liver may be at a lower level than normal.

Auscultation. The vesicular murmur is diminished in intensity and in marked instances may be inaudible; expiration is prolonged and may be very faint. Co-existent bronchitis may be evidenced by numerous râles of various types. The pulmonic second sound is usually accentuated but may be heard with difficulty, being overlaid by inflated lung. In cases with bronchial asthma there is sibilant and sonorous breathing.

Treatment. The co-existing chronic bronchitis or asthma should be treated according to the principles laid down in the sections devoted to these subjects (see pp. 635 and 639). The drug treatment of the disease itself may not afford marked relief and our chief dependence should be placed upon hygienic measures.

Young persons predisposed through heredity to this morbid condition

should guard with utmost care against any condition, mode of life or occupation which will make for the disease. All attacks of bronchitis should receive careful treatment and the general mode of life should be in accordance with the strictest hygiene. Fresh air, proper exercise and diet are necessities and excessive employment of the voice, the use of wind instruments and occupations entailing the breathing of impure air are to be studiously avoided.

With regard to drug treatment we have certain conditions to meet, notably the condition in the lung, the constant dyspnœa, the paroxysmal dyspnœa, the arterial contraction and the venous congestion. We have no drug, unless it be iodine, which can influence the connective tissue changes in the lung. It may be given as potassium iodide or in the form of the syrup of hydriodic acid and may be found to favorably influence the chronic dyspnœa of the disease, and the attacks of arterial contraction. These last may also be controlled by the administration of hydrated chloral or glyceryl nitrate.

The paroxysms of dyspnœa, when due to spasmodic contraction of the bronchial musculature, are to be treated similarly to ordinary asthmatic attacks (see p. 639). When they are the result of bronchial congestion heart stimulants, caffeine sodio-benzoate gr. v (0.33)—digitalis—fluidextract, ♏i–ii (0.065 to 0.13)—convalleria—fluidextract ♏ x–xx (0.66 to 1.33), may be given. This dyspnœa may also be relieved by drugs which increase the secretion of bronchial mucus, such as apomorphine hydrochloride gr $\frac{1}{32}$ (0.002), and dry cupping may be fuond useful in this connection.

Contraction of the arteries causing spasmodic dyspnœa may be treated by arterial dilators such as glyceryl nitrate, gr. $\frac{1}{100}$ to $\frac{1}{50}$ (0.0006 to 0.0012), hydrated chloral, gr. v to x (0.33 to 0.66) or inhalations of amyl nitrite.

Most observers at present consider the exhibition of expectorants in simple emphysema as useless.

The emphysema mixture which is found in most hospital and dispensary formularies may be found useful in certain patients, combining an expectorant with two antispasmodics and potassium iodide. The following formula is one in common use: ℞ potassii iodidi, ℥ii (8.0); tincturæ belladonnæ, ℥iii (12.0); spiritus ætheris compositi, ℥i (30.0); fluidextracti pruni virginianæ ℥ii (8.0); syrupi, ℥vi (24.0); aquæ destillatæ q.s. ad ℥iv (120.0). Dose 1 teaspoonful (4.0), every four hours.

Thoracic pain may be lessened by mild poultices of mustard or flaxseed, or by the application of squares of flannel wrung out in water as hot as can be endured, applied to the chest and covered with oiled silk; in this connection certain liniments, e.g., equal parts of menthol, hydrated chloral and camphor, well rubbed together, or an ointment of salicylic acid in lanolin 1 to 8 may be useful.

Hygienic treatment consists first in the institution of respiratory gymnastics and massage (which to a certain extent limber the ossified costal cartilages

and render the expansion and contraction of the thorax more like that of the normal chest) combined with general gymnastics. By these means much toward restoring the normal elasticity to the distended pulmonary alveoli may be accomplished. Pulmonary gymnastics have as their basis deep inspiration and expiration and the bringing into play as much as possible the accessory muscles of respiration. During the process the mouth should remain shut and the chest and abdomen must be free from the slightest constriction by clothing. The patient should remember that moving the arms from the chest aids inspiration and moving them toward the chest aids expiration. The simplest form of the gymnastics consists in raising the arms from the sides to the horizontal; during this motion the wrists are being supinated so that at its completion the palms shall be upward, and a deep inspiration is being taken. The movements are now carried out reversed in order and as the hands reach the sides the patient squats, bending hips and knees until the hands touch the floor. During the reversal of the exercise the patient should expire. These movements may be undertaken either with or without a light wooden dumbbell in either hand. When first undertaking this procedure the patient must be cautioned to rest after the completion of each series of movements and, even when accustomed to the exercise, five or six inspirations at a time will be found sufficient for most individuals; in certain patients it may be found advisable to omit the leg movements entirely. The amount of such exercise to be taken should be definitely laid down by the physician and he should personally instruct the patient in the carrying out of the movements.

Certain other forms of movements have been recommended for use in emphysema but those described above will be found efficacious and sufficient.

The use of the pneumatic cabinet is attended by good results but treatment by this means is expensive, inconvenient and in no way superior to that by means of respiratory exercises. The cabinet is so arranged that the patient undergoing treatment breathes air at a gradually increasing pressure for thirty minutes, then when the pressure has been augmented from 50 to 100 percent. it is kept stationary for from thirty to sixty minutes; during the last half hour of the *séance* the pressure is allowed gradually to fall to normal, too rapid reduction of the pressure being likely to have a bad effect on the patient. The good results accruing in many instances from this form of treatment are distinct but hard to account for. Lazarus, who has had much experience with this procedure, considers it absolutely contra-indicated in patients with calcified costal cartilages, rigidity of the chest and arterial degeneration.

Waldenburg's apparatus is based on the theory that if compressed air can be inspired the blood will be more thoroughly aërated and that if the patient expires into rarefied air the residual air will be withdrawn from the lungs.

The apparatus is complicated and costly and the results obtained from its use are more probably due to the respiratory gymnastics attendant upon its employment than anything else.

The appliance described by Strümpell consisting of two boards fastened together behind and applied one to each side of the chest is ingenious and simple. The patient, by grasping the projecting ends of the board in front and bringing them together, can considerably increase his respiratory power.

Compression of the thorax by means of corsets, belts and girdles of various patterns has been advocated but with regard to these and all other apparatus it may be said that respiratory gymnastics properly carried out are much simpler and afford quite as good, if not better, results.

Oxygen inhalations may be advised when the patient is suffering from extreme dyspnœa and cyanosis. They encourage the patient and relieve, temporarily at least, these distressing symptoms. When used as a routine they may affect favorably the heart's action and possibly benefit the lungs.

Massage with the hand or with the vibrator is an excellent method of rendering more flexible the ossified costal cartilages and difficultly movable ribs of the emphysematous thorax, and in addition it may have a favorable action upon a sluggish circulation. When massage is used in connection with warm douching, the temperature of the water should be about 100° F. (37.8° C.) and it should be applied in a single jet under pressure for from six to ten minutes. The massage produced by the jet of water increases the contractile power of the respiratory muscles and thus renders the inspiratory effort deeper and more easy. Experimentation has shown that after douching the lung capacity is increased and that the vesicular murmur, scarcely audible before, may be distinctly heard. Compression of the chest by the hands of the masseur during the douche and movements to aid in expansion and contraction of the thorax should increase the good effect, and the venous congestion at the same time may be lessened by the application of stroking movements away from the heart, along the body and limbs.

Climate in the treatment of emphysema is an important consideration for those whose circumstances render travel a possibility. With regard to the choice of a climate it may be said that in general the warm dry regions are preferable to those where the opposite of these conditions obtains. Some patients will, however, be found to thrive in warm moist regions and frequently a change from a warm dry climate to a warm moist one and *vice versa* will cause benefit. It is unnecessary to state that the air should be pure and free from contamination from dust or other substances. Moderate pedestrian exercise and, in patients in whom the heart is unaffected, hill climbing may benefit the patient.

The patient should be instructed not to dress so warmly as to interfere with his health and yet his clothing should be of sufficient warmth to prevent

catching cold, particularly if he be well along in years. Younger patients should take care to harden themselves so that they may be proof against sudden changes in the weather. The daily cool bath may be recommended to such as obtain a proper reaction after being subjected to it.

The diet should be plain, nourishing and easily digestible. Over-eating must be carefully avoided. The ingested fluids should be of moderate quantity and, while tea and coffee may be allowed in proper amounts, alcohol, except in old patients where it is needed as a stimulant, is to be forbidden. Abdominal distention must be guarded against and the bowels should be kept regularly open.

While it is doubtful if any of the mineral waters affects the disease in any way it is quite certain that life at the various spas, when the climatic conditions are proper, benefits many patients, probably because of the regulation of diet, exercise and mode of life prescribed at these resorts.

SYPHILIS OF THE LUNGS.

Synonyms. Pulmonary Syphilis; Syphilitic Pneumonia; Syphilitic Phthisis.

Ætiology. Syphilitic inflammations of the lungs may be either congenital or acquired; pulmonary syphilis in the new born is not very rare but the acquired inflammation in the adult is uncommon.

Pathology. Hereditary syphilis of the lung in the new born manifests itself as gummata scattered through the organ or as a consolidation of the lung tissue which is whitish in color and in which the alveoli are filled with an over-growth of epithelium which is sometimes fatty.

In adults syphilitic inflammation of the lung is characterized by the formation of gummata or of new connective tissue. From the growth of new tissue consolidation, constriction of blood-vessels or bronchi, and pleural thickenings may result. The new tissue is likely to break down and result in necrosis and ulceration.

Symptoms. In infants these are not diagnostic except in so far as they accompany specific manifestations in other organs. The patient loses weight and strength and presents the physical signs of pulmonary consolidation. The prognosis is distinctly bad.

In adults syphilis of the lung is usually a late tertiary lesion. The diagnosis is not easy but may be simplified by the history and the existence of other stigmata of specific disease. Cough may be present, with muco-purulent expectoration and occasional and usually small hæmoptyses, but is not a prominent symptom. There is, as a rule, progressively increasing dyspnœa, at first this is present only on exertion but later it becomes very urgent and is constant. There may be a moderate degree of fever but this is more commonly absent; thoracic pain is an inconstant symptom.

The condition is a chronic and progressive one lasting for months with gradually increasing weakness and emaciation.

The physical signs offer little help in diagnosis. They are most prominent over the roots of the lungs in contradistinction to those of pulmonary tuberculosis which are more likely to be at the apices, and depend upon the anatomical condition of the organ.

The co-existence of syphilis and tuberculosis of the lung has been observed.

Treatment. As soon as the syphilitic origin of the condition is suspected the patient should be put upon a vigorous antisyphilitic treatment, and under favorable conditions, a cure should be perfectly possible. Inunctions of mercury should be prescribed; about half a drachm (2.0) of unguentum hydrargyri should be thoroughly rubbed into the skin, a different part being chosen each day for six days and the underclothing should not be changed until the end of this period when the patient is allowed to take a bath. This routine is continued for six weeks and for the latter half of the period the dosage of the mercury is increased by one-half. Salivation should be guarded against by the daily use of a mouth wash of potassium chlorate, two to four percent. solution.

The use of the iodides is said to be less satisfactory than that of mercury; they may, however, be employed. Their dosage should be regulated by the results obtained. Either potassium or sodium iodide or the syrup of hydriodic acid may be employed. (See the section upon the treatment of syphilis)

Most authorities consider that concurrent pulmonary tuberculosis is not a contra-indication to the use of antisyphilitic remedies.

NEOPLASMS OF THE LUNGS.

Ætiology. New growths of the lungs are either primary or secondary. They may be of carcinomatous, sarcomatous or lymphomatous type. Of these the first may occur either as a primary or a secondary tumor while the two latter occur secondarily only.

Pathology. Primary carcinomata of the lung usually begin in the walls of the small bronchi. Both the primary and secondary carcinomata progressively increase in size and either compress the bronchi or are associated with exudative or productive inflammation in such a manner that they result in consolidation of portions of the lung of greater or less size, or suppuration may take place with the formation of abscesses. The pleura may be secondarily involved.

Pulmonary sarcomata are secondary to primary growths of other parts. They usually occur as scattered nodules or as larger tumors which compress the bronchi. Secondary involvement of the pleura may take place.

Lymphomatous tumors have their inception in the bronchial glands and develop from the root of the lung along the course of the bronchi or of the septa between the lobes of the lungs.

Physical Signs. These are due to the compression of the bronchial tubes, in which case we obtain tubular, diminished or absent breathing over the affected tubes; to the areas of pulmonary consolidation, in which the usual signs of localized consolidation are present; to the presence of fluid in the pleural cavities, where the typical signs of pleuritic effusion are obtainable.

Symptoms. The most prominent symptom is slowly increasing dyspnœa. At first it may be slight and present upon exertion only, later it is continuous and severe. It is due to the pressure of the growth upon the bronchi. There may be cough with muco-purulent expectoration which at times is blood-stained, a slight febrile movement and thoracic pain. There is progressive loss of flesh and strength with the gradual appearance of the typical cancerous cachexia. If there is history of a previous new growth of some other part the diagnosis is simplified, otherwise it is difficult unless the sputum contains bits of tissue, which, upon microscopical examination, prove to be cancerous in origin.

Treatment. This consists in rendering the patient as comfortable as possible and meeting indications as they rise. (See treatment of new growths of the pleura, p. 670).

HYDATID DISEASE OF THE LUNGS.

This is an infrequent condition and is difficult of diagnosis unless fragments of cyst wall or hooklets are demonstrated in the sputum. The symptoms and physical signs resemble those of other pulmonary growths.

Treatment. According to most observers patients with this affection do better if operative intervention is undertaken. This consists of either aspiration of the cysts and withdrawal of their contents, or preferably pneumotomy. The latter procedure consists in cutting into the cyst, evacuating its contents and if possible removing the cyst wall.

ABSCESS OF THE LUNG.

Synonym. Pulmonary Abscess.

Ætiology. The cause of abscess in the lung is infection by one or more of the varieties of pus-forming micro-organisms. Pulmonary abscess may result from traumatism, from the lodgment in the lung of septic emboli from other parts of the body, or from foreign bodies. It may be secondary to other

pulmonary inflammations such as broncho- or infectious pneumonia or it may result from the bursting of abscesses in other parts, hepatic, subdiaphragmatic, mediastinal, pleural, etc., into the lung. It is quite possible for extraneous collections of pus to be discharged into the lung and to be expectorated without the formation of a true pulmonary abscess.

Pathology. Abscess of the lung is usually multiple; when single it is usually a sequela of pneumonia, the result of a wound or the lodgment of a foreign body. Pulmonary abscess exists as a diffuse suppurative process without limitation by an abscess wall or as a discrete collection of pus shut off from the surrounding tissue; such abscesses may result in recovery with the formation of fibrous tissue which, by its contraction, finally closes what was formerly the abscess cavity.

Abscess may result from the infection of a hydatid cyst of the lung.

Symptoms. In the early stages pulmonary abscess may give no distinctive symptoms, the patient complaining of nothing more than cough with little or no expectoration, and an irregular febrile movement. As the disease progresses the temperature becomes more distinctly septic in type and there may be sweats and chills. There is usually a marked leucocytosis (25,000 to 40,000 or more) and the sputum may become increased, purulent and may contain shreds of connective tissue. Pyogenic bacteria may be demonstrable but no tubercle bacilli are present. The sudden rupture of a large abscess cavity is evidenced by the expectoration of a considerable amount of pus and such a circumstance is strongly suggestive of the presence of this lesion. After rupture such an abscess may proceed to heal and perfect recovery may follow. Less favorable instances continue expectorating pus from time to time, gradually becoming weaker as a result of the toxæmia due to septic absorption, until death takes place from this or from loss of blood consequent upon the erosion of a vessel.

Physical Signs. Small multiple abscess rarely gives physical signs. Abscess following pneumonia presents the signs of the primary condition. In a word the diagnosis of pulmonary abscess by physical examination alone is all but impossible.

Treatment. The patient's strength should be sustained by plenty of nourishing and easily digestible food. Exposure should be avoided but life in the open air in a proper climate is of great benefit. Drug treatment with a view to the production of antisepsis of the bronchial tract by means of inhalations and internal medication as described under the treatment of bronchiectasis is indicated.

Tonics such as iron and codliver oil, and stimulants such as alcohol and strychnine, will be found useful.

Sedatives to relieve the distressing cough may be employed. Of these heroine and codeine, with morphine as a last resort, are the best.

Surgical measures may be employed when the location of the abscess can be distinctly fixed and when, despite medical treatment, there is no tendency to recovery. The abscess should be localized with an aspirating needle and when the pus is found the instrument should be left *in situ* in order that the seat of the process may be easily found during the operation; then under chloroform anæsthesia the thoracic wall and pleura—the latter being sutured as soon as divided to prevent the entrance of air—are incised, pneumotomy is performed, the abscess cavity is opened, drained, without irrigation, and dressed.

GANGRENE OF THE LUNG.

Synonym. Pulmonary Gangrene.

Definition. Death of pulmonary tissue with putrefaction.

Ætiology. For the production of pulmonary gangrene impairment of the vitality of a portion of the lung and infection with the micro-organisms of putrefaction are necessary. The most common causes which bring about these results are infectious pneumonia, pulmonary infarcts, embolism of the pulmonary or bronchial blood-vessels, injuries to the lungs, the presence of foreign bodies and the extension of infections from the mediastinum, œsophagus, thoracic wall, ribs, vertebral column or the abdominal cavity. The pressure of new growths and aneurysms may interfere with the pulmonary blood supply to such an extent as to cause gangrene. Lastly, instances may occur without assignable cause. Adult males are most often affected.

Pathology. The gangrenous process may affect a greater or less portion of the lung tissue. It may be single or occur as multiple foci, soft, dark greenish in color and of most fœtid odor; the foci may become cavities with foul contents and ragged walls. The surrounding pulmonary tissue is the seat of an inflammation with the exudation of fibrin and pus. The neighboring blood-vessels may become plugged with infectious thrombi from which emboli may be separated and carried to various parts of the body, or erosion of these vessels followed by hæmorrhage may take place. If the focus is near the pleura there may be a complicating empyema or pyopneumothorax. There is usually a bronchitis due to the passage of the gangrenous exudate through these tubes. Gangrenous foci may heal leaving behind cavities with walls of connective tissue. The process usually affects a portion of one of the lower lobes but it may involve an entire lung.

Symptoms. Early in the disease these may be indefinite but the patient exhibits prostration, rapid and feeble heart action and respiration, and an irregular febrile movement. Cough is present but the sputum is neither abundant nor characteristic until the gangrenous foci break down. When

this has taken place the breath becomes very foul and the sputum extremely fœtid. On standing it separates into three strata, the uppermost frothy, opaque and dirty-yellow or grayish, the middle thin and mucoid and the lowermost green or brownish and containing shreds of dead lung, pus, red blood cells, bacteria, and crystals of the fatty acids and of leucin and tyrosin. Considerable hæmoptyses may occur due to the erosion of blood-vessels by the gangrenous process.

As the disease goes on the condition of the patient may become septic, loss of flesh and strength is progressive, and suppurative processes in other parts of the body may be set up by the lodgment of septic emboli.

Physical Signs. In small areas of gangrene these may not be well-marked but over large foci the percussion note is dull or flat, the breathing is absent (Béhier–Hardy's sign) or bronchial, the voice increased or bronchial. There may be coarse, moist or subcrepitant râles. If the pleura is involved the physical signs of effusion or pyopneumothorax are obtainable.

The prognosis of this condition is distinctly not good but recovery may take place. Instances complicated by empyema are said to be more likely to recover than those not so affected.

Treatment consists in keeping up the patient's strength by proper food, stimulation by means of strychnine and alcohol, and the administration of medicaments with a view toward neutralizing the septic process. Inhalations, such as those described under the treatment of bronchiectasis, (p. 643) are indicated. Phenol solution, 4 percent., may be administered in this manner by means of an atomizer or the drug may be administered internally—a half ounce (15.0) of a one-half percent. solution flavored with peppermint water, three times a day. Hæmoptyses may be controlled by the administration of plumbi acetas gr. i (0.065), sacchari q.s. ad gr. x (0.66), one powder three times or more daily, or by means of calcium lactate 20 grains (1.33) three times a day.

The cough may be relieved by heroine or codeine in the usual doses and when these fail, recourse may be had to morphine.

The use of quinine in moderate doses is recommended on account of its antipyretic action and it is said to possess antiseptic properties as well.

Operative treatment may be considered when the septic process continues despite other treatment and when the patient is manifestly doing ill. It is particularly indicated when there is pleural involvement or when the gangrenous focus can be demonstrated to be near the chest wall. The fact that instances complicated by empyema are likely to do well should be an argument in favor of surgical treatment even when the pleura is not involved. The technique is the same as that of the operation for pulmonary abscess (p. 654) and it is important that the anæsthesia should be as short as possible.

DISEASES OF THE PLEURA.

ACUTE FIBRINOUS PLEURISY.

Synonyms. Pleurisy with the Effusion of Fibrin; Fibrinous Pleurisy; Dry Pleuritis.

Definition. An acute inflammation of the pleura resulting in the production of fibrin upon its surface.

Ætiology. Dry pleurisy may result primarily from exposure to the inclemencies of the weather; it may be secondary to injuries of the chest walls such as fractures of the ribs, to inflammations of the lungs, to the infectious diseases, especially influenza, and to chronic nephritis. The causative factor of rheumatic inflammations having a predisposition to attack the serous membranes makes the supposition probable that there is a rheumatic element in many instances of this condition.

Pathology. The inflammation begins upon the pulmonary or the costal pleura depending upon the causative factor and extends to the opposite pleural surface. As a rule there is only a limited area of the pleura involved; rarely the entire pleura of one side may be affected. The inflamed surfaces are coated with an exudation of strands of fibrin which forms adhesions between them and in the meshes of which there is an exudation of a gelatinous fluid which tends to become organized, causing persistent adhesions between the pleural surfaces.

As the inflammation subsides the exuded fibrin tends to become absorbed but the pleura usually remains thickened and often permanent adhesions remain.

Symptoms. In the less severe instances the only symptom may be a severe knife-like pain in the chest which is especially marked upon deep inspiration or upon movements of the thorax or arms. Patients affected with more extensive inflammation of the pleura exhibit a moderate fever, general pains, prostration, a cough without expectoration and a lack of inclination to deep respiration. Markedly extensive pleural involvement with the exudation of large amounts of fibrin causes symptoms resembling those of acute lobar pneumonia.

As a rule the acute symptoms last from three to ten days but unless prompt and proper treatment is instituted permanent pleural thickenings and adhesions remain which may result in chronic thoracic pain occurring especially in damp weather.

Diaphragmatic pleurisy may resemble peritonitis in its symptoms since the pain is most marked along the costal margin; there may also be pain and tenderness in the upper part of the abdomen. Mediastinal pleurisy is very difficult of diagnosis.

Physical Signs. *Inspection* may reveal a diminished respiratory excursion

on the affected side. *Palpation*, in old instances with permanent adhesions, may show areas of an increase in vocal fremitus due to its transmission through the organized tissue. On *percussion*, if there is a considerable exudation of fibrin, dulness is present over the inflamed area. *Auscultation* over the site of the inflammation reveals the most typical physical sign of the lesion which is the presence of friction sounds, crepitant or subcrepitant râles, which may not be audible unless the patient breathes deeply. The voice over organized adhesions will be found to be high pitched.

If the inflammation involves the diaphragmatic pleura only, the patient should be examined with his arms extended above his head. This fixes the diaphragm and the râles may be heard along the costal attachment of this muscle. Pressure under the costal margin causes these râles to increase in number and pressure in the left hypochondrium may cause intense pain (De Mussey's sign).

Treatment. In the milder forms of the disease the patient need not be confined to bed, but if there is much pleural involvement and a febrile movement this precaution is necessary. The administration of antipyrine salicylate (salipyrine) in doses of 10 grains (0.66) every two to four hours will effectually control the pain as a rule, and inunctions over the painful area three times daily of a drachm (4.0) of an ointment composed of oil of turpentine, salicylic acid and lanolin of each 1 drachm (4.0) and simple ointment 5 drachms (20.0) will usually cause absorption of the exudate and obviate the formation of lasting adhesions. Every precaution should be taken to break these, for, if they become permanent, the lung, owing to its consequent deficient aëration, becomes a fertile soil for tuberculous infection. Consequently strapping of the chest with adhesive plaster should never be employed, for while it relieves the pain, it immobilizes the chest and allows the pleural surfaces to become firmly adherent. Blisters and cupping also should never be used since they increase the exudation and augment the possibility of the formation of permanent adhesions. Sodium salicylate may be given by mouth instead of salicylic acid by inunction but the former has no advantages over the latter method and the salicylates are prone to disturb digestion.

If the pain is not relieved by the above treatment, various local applications in the form of compresses, hot or cold—whichever affords more relief—may be prescribed. Painting the painful area with the tincture of iodine is a much employed form of counter-irritation and anodyne ointments such as the following may be found to have a field of usefulness: ℞ chlorali hydrati, camphoræ, āā gr. xv (1.00); unguenti, q.s. ad ℥i (30.0). Misce et signa—External use. Or ℞ mentholis, gr. xv (1.0); cocainæ hydrochloridi, gr. v (0.33); unguenti, q.s. ad ℥i (30.0). Misce et signa—External use.

The hypodermatic injection of morphine is usually unnecessary and should be employed only as a last resort.

Calomel given early in the disease is said to diminish the exudation of the fibrin and to prevent the inflammation from going on to an effusion of serum. Certainly the drug can do no harm.

Sthenic inflammations with high temperature at the onset of the disease may be benefited by the administration of aconite or veratrum with the idea of "bleeding the patient into his own tissues" and the use of these drugs is certainly preferable to the more drastic procedure of venesection.

Diaphoretics are recommended by certain authorities but in fibrinous pleurisy they seem hardly necessary, however, a hot, wet pack or two or the pack in a heated sheet covered with blankets following a warm bath, may make the patient more comfortable. The use of pilocarpine hypodermatically in doses of $\frac{1}{8}$ of a grain (0.008) is also advocated by some in this connection.

The chronic adhesions that so often follow this form of pleurisy as well as those with the effusion of serum or pus, are best treated by thoracic massage, either with the hand or with the vibrator, and by means of respiratory gymnastics (see p. 635). Here inunctions of iodine vasogen and the internal administration of iodine in the form of potassium iodide—gr. x–xv (0.66–1.0) three times a day—or better the syrup of hydriodic acid—1 drachm (4.0) before each meal—may have a certain influence over the absorption of the organized tissue between the pleural layers

The diet in mild instances of fibrinous pleurisy may consist of plain and easily digestible solids but if there is any considerable elevation of temperature the patient would best be restricted to fluids while this lasts.

ACUTE SEROUS PLEURISY.

Synonyms. Serous Pleurisy; Pleurisy with Effusion. Pleuritis with Effusion.

Definition. An acute inflammation of the pleura accompanied by the exudation of fibrin and the effusion of serous fluid into the pleural sac.

Ætiology. There is a considerable tendency, especially on the part of German clinicians, to regard all instances of serous pleurisy as tuberculous in origin. While in certain patients infection with the bacillus tuberculosis is undoubtedly responsible for the incidence of this inflammation it seems hardly wise to make so sweeping a statement as the above, but to take a more conservative view. It is probable that any of the causes of fibrinous pleurisy may produce the serous form of pleuritic inflammation.

Pathology. The lesion involves, as a rule, most of the pleura of one or both sides. When the latter is the case the pericardium is likely to share in the inflammation. The pleural surfaces are coated with fibrin and gelatinous material just as is the case in fibrinous pleurisy, and in addition the pleural cavity contains clear, turbid or slightly blood-tinged serum, in which last case

the observer should suspect the presence of tuberculosis, a blood dyscrasia or the existence of a pulmonary or pleural new growth. In quantity the fluid may reach several quarts (litres).

Microscopical examination of the exudate reveals leucocytes in small number, at times red blood cells, fibrin and endothelial cells. Chemical examination shows the fluid to be rich in albumin and sometimes to contain sugar, urea and uric acid. A fluid of high specific gravity, 1,012 to 1,024, containing a large amount of fibrin and albumin, with an accompanying lymphocytosis is very probably of tuberculous origin. The demonstration of the tubercle bacillus in pleuritic effusions even when these are of tuberculous origin, is difficult.

The presence of the effusion, if in sufficiently large amount, causes compression of the lung, displacement of the heart—a large exudation into the left pleura sometimes pushing this organ to the right side of the thorax—and of the abdominal viscera.

After the subsidence of the inflammation and absorption of the serum and fibrin, pleural thickenings and adhesions are usually left behind and the compressed lung may not regain its normal expansion, as evidenced by a certain amount of retraction of the thoracic wall of the affected side.

Symptoms. The disease may begin with a chill followed by a rise in temperature (101°–103° F.—38.3°–39.5 C.), and bodily pain, or the onset may be gradual, with malaise, dry cough and prostration. There is likely to be a severe, knife-like pain which may be over the inflamed pleura or reflected to the opposite side of the chest or to the abdomen. This pain is increased upon respiration and coughing. The respirations are accelerated and are likely to be shallow because of the increased pain attendant upon deep breathing. As the fluid begins to exude from the affected pleural surfaces the pain usually subsides but the breathing remains shallow, now because of the diminishing ability of the lung to expand. The acute symptoms now gradually grow less marked but, unless removed, the fluid remains for days or weeks before it is finally absorbed.

In the pleurisies of protracted course the patient may not seem ill enough to be confined to bed, yet he loses flesh and strength, has a moderate febrile movement and suffers from dyspnœa, pain in the chest and cough. In such instances a tuberculous origin of the inflammation should be suspected and frequent physical examinations of the chest should be most critically made.

In pleurisy with effusion, especially when complicating an acute infection, the possibility of the fluid becoming purulent must be kept in mind.

Physical Signs. Early in the course of the inflammation before the exudation of the serum the signs are those of a dry pleurisy. (See p. 657.) After the disappearance of the fluid there are likely also to be friction sounds heard over the resulting pleuritic adhesions. While the fluid is present, below its

level *palpation* reveals absence of vocal fremitus and the *percussion* note is flat. Grocco's sign, a triangular area of dulness upon the unaffected side may be present. This area is bounded by the line of the spinous processes of the vertebræ, by the lower limit of normal pulmonary resonance and by a line rising from this boundary to the median line at or about the upper limit of the dulness due to the fluid. The base of this triangle is from one-half to one inch or more in length. Upon *auscultation* the classical signs are absence of vocal resonance and of the respiratory murmur, but almost as frequently both voice and breathing are bronchial; aphonic pectoriloquy may be present (Baccelli's sign). At the level of the fluid the *percussion* note is usually dull and the voice and breathing are bronchial in quality; at times ægophony may be present. Above the fluid the compressed lung gives normal, highly pitched or tympanitic resonance (Skoda's sign) and the voice and breathing are normal; more rarely they are broncho-vesicular or bronchial. Vocal resonance is normal or slightly intensified. Measurement is likely to show an increased girth of the affected side, and examination of the heart may reveal a displacement toward the unaffected side. Upon Röntgen ray examination the presence of the fluid may cause a dark shadow in the fluoroscopic picture or upon the plate, and a displacement downward of the diaphragm.

As the fluid disappears the area over which voice and breathing are audible extends gradually lower, the percussion note becomes less flat and finally dull. The dulness is likely to persist owing to the pleuritic thickening.

Sacculated effusions are not rare but when small may escape notice. Their physical signs are very irregular. The use of the exploring needle is of great assistance in diagnosis

Treatment. The patient should be kept in bed and on a light but nourishing diet. Before the exudation of the serum the treatment described for fibrinous pleurisy should be instituted and the intestinal tract should be cleared by the use of calomel in divided doses, followed by a saline.

The attempt to diminish the effusion by means of diuresis and purgation may be made by various methods of which perhaps the best is that of Matthew Hay. Two ounces (60.0) of magnesium sulphate are dissolved in an equal amount of boiling water; the mixture is allowed to cool and is given in the evening. The patient is directed to drink no fluids before noon of the next day. Before this time an increase in the excretion of urine will be noticed, several watery stools will be voided and the quantity of pleuritic fluid may be diminished. This medication may be repeated if necessary.

Other diuretics may also be employed such as the Guy's hospital diuretic pill—calomel, powdered digitalis and squill, of each 1 grain (0.065),—caffeine, diuretin, theocin, etc., in appropriate dosage. Ortner, in this connection, speaks of the use of urea—5–10 grains (0.33–0.66)—but this substance, as

well as the diuretics mentioned and other drugs of this class, will usually be found to have only a limited influence in the reduction of the serous exudate.

Diaphoretics have also been employed with the hope of lessening the effusion but their influence is not marked. Hot air or steam baths may be employed but the discomfort which they are likely to cause more than over-balances any benefit that may accrue from their use.

The salicylates, because of their influence over inflammations of serous membranes, may be given by mouth in ordinary dosage.

Recently much research into the influence of the chlorides of the diet upon dropsical conditions has been carried out with the result that we are now able to facilitate the absorption of serous exudates and transudates by means of regulating the amount of these substances contained in the ingested food. All serous fluids require at least 75 grains (5.0) of sodium chloride to the quart (litre) in their composition to prevent their osmosis into the circulating blood, consequently, if the diet is so arranged that it shall be lacking in this substance such osmosis and absorption is expedited. In view of this fact patients suffering from pleurisy with effusion may be proper subjects for this form of treatment and the result attained may justify the attempt.

Certain clinicians, notably Delafield, assert that as soon as fluid enough to give physical signs has accumulated, it should be drawn off by thoracic paracentesis as a curative measure without waiting for the evidences of respiratory embarrassment, but more conservative observers consider that the operation need not be performed until these manifestations are clear. A safe rule by which to be guided is to aspirate when the respirations exceed twenty-four to the minute without waiting until the fluid becomes a mechanical obstacle to the heart action and breathing, as shown by marked dyspnœa and cyanosis.

Technique of Thoracocentesis. The operation may be performed with various forms of apparatus, but is most usually done with the Potain aspirator which is too well known to need description. A still simpler method is to employ a large-mouthed bottle containing about two quarts (litres). In this a vacuum can be created by burning a drachm (4.0) or two of alcohol. The only other appliances necessary are a few feet of rubber tubing, to one end of which the aspirating needle is attached while its other end is fixed to a glass tube which penetrates the cork fitted to the bottle, and an artery clamp. All the joints must be air tight. To use this form of aspirator the air should be exhausted from the bottle and the cork inserted. The needle is plunged into the chest, the artery clamp removed from the tube and the fluid allowed to run. A needle of fairly large calibre should be employed, for, especially if the operation is done late in the disease, the albuminous flocculi which may be contained in the exudate are likely to get into the needle and stop it.

The procedure must be carried out in the strictest accordance with the principles of asepsis. The hands of the operator must be sterilized, the needle freshly boiled and the patient's skin prepared as for a surgical operation, for not infrequently a serous pleurisy has been converted into an empyema by the faulty technique of the operator, an accident which, it is needless to say, should never occur. The proper precautions having been taken and the point selected for puncture—usually the first intercostal space below the angle of the scapula—anæsthetized by the ethyl chloride or æther spray, the patient sits up in bed and is told to place the hand of the affected side upon his head, in order to raise the scapula and widen the spaces between the ribs as far as possible; the needle is gently but firmly forced through the wall of the chest into the fluid-containing cavity. After a little experience it is easy to tell whether the needle is in the fluid or has penetrated the lung—an accident upon which, fortunately, no bad results are attendant. The needle now being in the effusion, this is allowed to run into the bottle. If the fluid is in large quantity it is unwise to remove it at one sitting, since there may be a certain amount of shock attendant upon the displaced lung and heart being suddenly allowed to resume their normal positions, but it is better to wait until another day before draining the pleura completely. During the procedure the patient's pulse and general condition should be carefully observed and upon the appearance of any untoward symptom the needle should be at once withdrawn. As the quantity of fluid flows off, at times, the patient develops a cough, which, if it is frequent or distressing, is an indication that no more fluid should be removed. The needle being withdrawn the puncture should be dressed with a bit of sterile gauze or cotton held in place by a strip of adhesive plaster.

In certain patients re-accumulation of the fluid may render necessary one or more repetitions of the operation; in the prevention of this occurrence depletion by means of diuretics and purgatives is likely to be found useful.

Counter-irritation in pleurisy with effusion may relieve the pain to some extent but it is doubtful if it has any influence upon the disease itself. Such means, however, as painting the chest with tincture of iodine pure or in collodion (one part in ten) or inunctions with iodine-vasogen may be employed; the latter being especially useful in the adhesions and thickenings which result after the disappearance of the fluid. (See also p. 667.) After this has taken place, if the effusion has been large and the lung has been subjected to considerable compression, the expansion of the organ will be facilitated by the employment of such pulmonary gymnastics as those described in the section devoted to the treatment of emphysema (q. v.) or the use of the so-called James' bottles. A simpler means consists in taking as deep inspirations as possible and forcibly blowing out the inspired air through a bit of glass tubing or a pipe stem.

During convalescence the patient's food should be of the most nourishing

character and tonics, such as codliver oil, iron, the vegetable bitters, etc., should be prescribed.

Oftentimes recovery will be accelerated by a change of climate, the most preferable being one of mild temperature and dry atmosphere.

EMPYEMA.

Synonyms. Pleurisy with Purulent Effusion; Purulent Pleurisy; Purulent Pleuritis; Pyothorax.

Definition. An inflammation of the pleura characterized by the exudation of fibrin upon the pleural surfaces and of purulent fluid into the pleural cavity.

Ætiology. The disease may be primary following exposure but it is more usually secondary to a serous pleurisy, to inflammations of the lungs or to abscesses of the chest wall, the lung, the liver or of the abdomen, which have ruptured into the pleural cavity.

Pathology. Empyema usually involves the entire pleural cavity of one or both sides, but it may affect only a limited portion of the pleura, in which case the inflammation is said to be sacculated. The affected pleura is covered with fibrin and pus and is frequently much thickened. Its cavity contains in its lowest portion purulent fluid, in greater or less amount, which pushes the lung upward and compresses the organ to a greater or less degree depending upon the quantity of the exudate. Circumscribed collections of pus may occur in any part of the pleural sac; communication may exist between the pleura and the lung, and pus may escape into this organ and be expectorated or the pus may escape through a rupture in the wall of the thorax.

Examination of the fluid shows it to contain many pus cells, more or fewer red blood cells, and various micro-organisms of which staphylococci, streptococci and either of the varieties of pneumonia bacilli are the most common.

Symptoms. In the primary infections the onset of the inflammation is marked by a chill, followed by a rise in temperature and prostration usually more marked than those of serous pleurisy. There are general pains, dry cough, dyspnœa, and pain in the chest, especially upon deep inspiration. Death may occur within a few weeks from septic poisoning or the inflammation may become chronic.

When the disease is secondary to pleurisy with effusion the onset of the purulent inflammation is more gradual and is marked by increasing prostration and a temperature of septic type. A pneumonia may run directly on to empyema or the symptoms of the latter condition may not appear until defervescence has taken place and convalescence has become established. In the latter event the patient will exhibit a sudden rise of temperature, an increase of the prostration, and physical examination will reveal the signs of pleuritic fluid.

If the disease passes on into the chronic stage it may last for months or years; the patient loses flesh and strength, suffers from shortness of breath, has more or less cough and a septic temperature. There may be rupture into the lung and expectoration from time to time of pus in greater or less quantity, or the pus may be discharged outward through the wall of the chest. In some instances the inflammation may become gangrenous and death from pyemia may result. In the chronic condition the patient may improve, but there is usually some pus left in the pleural cavity, either free or circumscribed, and infection with the tubercle bacillus is a frequent occurrence. If this does not take place the subject continues in a state of chronic sepsis and becomes more and more weak until relieved by death. Without proper treatment recovery seldom or never takes place.

Physical Signs. These are usually identical with those of serous pleurisy but irregularities are frequently noticed. The observer should not be deceived by the existence of râles and friction sounds below the level of the fluid, since these may occur, and when the diagnosis is doubtful, it is the part of wisdom to use the exploring needle. The signs of sacculated empyema are especially likely to be such as to cause doubt and here the aspirating needle should be used without hesitation as a means of making the diagnosis certain.

Treatment. This is essentially surgical. The treatment by means of simple aspiration may be attempted in the case of children, but in adults it is practically useless. Here the chest must be opened, one or more ribs resected and the fluid removed. In children also, if the fluid re-accumulates after several attempts at cure by tapping, the more radical treatment becomes necessary.

Sacculated collections of pus may not recur after aspiration, consequently it is wise to employ this means tentatively, introducing the needle at the point of maximum flatness.

When the amount of fluid is considerable, preliminary thoracocentesis should always be done, since the sudden removal of a large quantity of fluid and its consequent pressure upon the vital organs, is likely to result in shock of no little intensity. Following this procedure the radical operation should be performed. The interval may be from a few hours to a day or two, depending on the condition of the patient.

The technique of the operation should be adapted to the patient in hand. In children simple incision of an intercostal space may be all that is required but more usually it will be found necessary to remove a section of one or more ribs in order that the pleural cavity may be thoroughly cleared of the products of the inflammation.

Simple incision is usually performed in the fourth or fifth space or over the point of maximum flatness; its anterior extremity should be well forward, at least as far as the anterior axillary line and it should be continued backward

for two or three inches. The skin, intercostal muscles and finally the pleura are divided, the incision is widened as much as possible and the pus is allowed to flow slowly out, in order that sudden relief of the intra-thoracic pressure may not interfere with the action of heart and lungs.

Following the evacuation of the pus the fingers should be introduced and all shreds of fibrin, albuminous coagula, etc., removed. Most clinicians agree that irrigation of the pus cavity is harmful rather than beneficial. The pleura, having been cleansed, drainage tubes of proper calibre and length (two, preferably, which will provide against the interference with free drainage should one become stopped) are inserted and the wound is dressed. The outer end of each tube should be transfixed with a safety-pin with a cord attached to prevent its entrance into the pleural cavity. A small wad of gauze should be about the tube between the pin and the chest wall lest traumatism take place. A small quantity of iodoform powdered upon tubes and dressing will assist in preventing putrefaction and will hasten the healing process. This substance may also be sprinkled through the incision but care should be taken to provide against any possibility of intoxication; 20 to 40 grains (1.33 to 2.66) may be employed without apprehension and later a smaller amount will suffice. The dressing should contain plenty of absorbent material, for the discharge, at any rate at first, is considerable. Following the operation the dressings should be changed daily—oftener if necessary—but as the healing process progresses the intervals may be longer. The patient should be carefully watched and any rise in temperature usually signifies an interference with free drainage and necessitates examination of the condition of the wound.

As the lung expands and the pus cavity proceeds toward healing the tubes should be shortened from time to time until finally a drain of iodoform gauze may be substituted. Before removing the tubes one should make certain that no fistulous tracts or sinuses remain and that the pleural cavity is properly obliterated.

The more radical operation of exsection of portions of one or more ribs, by some authorities, is considered preferable to the intercostal incision. The rib removed is usually the sixth, seventh or eighth and of this from a few inches to its whole length are resected subperiosteally, removed, and the pleura is incised and drained as in the operation by simple incision. At times it becomes necessary to remove parts of two or more ribs, and as a secondary operation, in rare instances a thoracoplasty is indicated.

The operations described above are usually performed under general anæsthesia but that of pleural incision may be, when desirable, done under the influence of a local anæsthetic. It should be unnecessary to state that in these as in all other operations the strictest aseptic precautions must be observed.

After operation the obliteration of the pleural cavity takes place in varying lengths of time. It may close within a week or two or a discharging sinus

may persist for months. The after-treatment consists of the employment of all means suitable to maintain the strength of the patient, such as generous diet, comprising, among other articles, plenty of milk and cream, the administration of codliver oil, iron and other tonics as indicated, and fresh air. Before the patient can leave his room he should be dressed as if for out-of-doors and the windows should be thrown open for several hours each day; when able to walk he should be encouraged to seek the open air as much as possible. Much benefit often accrues from a change of climate.

Respiratory exercises calculated to expand the lung, such as those described under the treatment of serous pleurisy, should be ordered.

In instances which continue the discharge of purulent fluid from the pleura for a protracted period the employment of inunctions with unguentum Credé may favorably influence the suppurative process.

CHRONIC ADHESIVE PLEURISY.

Synonym. Chronic Adhesive Pleuritis.

Definition. A chronic inflammatory condition of the pleural surfaces characterized by the production of connective tissue adhesions.

Ætiology. Chronic adhesive pleurisy, usually, is a sequela of the adhesions resulting from attacks of fibrinous, serous or purulent pleurisy. It may follow acute pneumonia or complicate tuberculous inflammations of the lungs. In certain patients the lesion seems to be primary.

Pathology. The connective tissue growth, as a rule, begins in the cicatricial adhesions which previous pleuritic inflammations have left behind and progresses until more or less of the surface of one or both lungs is firmly attached to the chest wall. These adhesions are often so firm that the greatest difficulty may be experienced in separating them. There may be displacement of the heart, contraction of the wall of the thorax or spinal curvature, as a result of the contraction of this growth of connective tissue.

Symptoms. Early in the disease, before the adhesions have involved any great amount of the pleural surface, there may be merely slight dyspnœa, pain in the chest, increased on inspiration, and cough. As the inflammation progresses these symptoms become more marked, there is interference with the heart action, due to the adhesions, and consequent displacement of the organ, and the patient becomes weak and emaciated and an easy prey for any intercurrent affection.

Physical Signs. Over the adhesions the percussion note is dull, the voice and breathing are harsh and intensified and there are sounds due to the friction of the pleural surfaces.

Treatment. This consists in avoiding exposure to cold and dampness as much as possible and when practicable, advising life in the open air in a

climate where pulmonary affections are uncommon. Pulmonary gymnastics, respiratory exercises and thoracic massage (see p. 648) will be found useful in combating the interference with respiration. The patient's nutrition should be kept up by means of a generous and easily digestible diet containing plenty of milk and cream, and the administrations of such tonics as cod-liver oil, iron in appropriate form and the vegetable bitters. The heart weakness may require the use of strychnine. For the pleuritic pain counter-irritant liniments and ointments may be employed. An excellent liniment may be made by triturating hydrated chloral, camphor and menthol in equal parts. Inunctions of iodine-vasogen ointment with a view to possible absorption of the adhesions may be prescribed.

In certain instances of contracted chest resulting from adhesions following empyema, relief may be sought at the hands of the surgeon.

HYDROTHORAX.

Definition. An accumulation of serum within the pleural cavity.

Ætiology. This condition is a frequent accompaniment of anasarca due to any cause, the most usual ones being nephritis or chronic endocarditis. The effusion is a non-inflammatory one and therefore a transudate rather than an exudate. It is the result of an interference with the proper circulation of the blood through the pleural membranes. The transudate is usually bilateral but this is not always the case.

Symptoms and physical signs are identical with those of pleurisy with the effusion of serum but there is likely to be less pain and there may be no febrile movement.

Treatment will be considered under the treatment of the causative conditions.

HYDROPNEUMOTHORAX; PYOPNEUMOTHORAX.

Definition. A condition characterized by the presence of air and fluid, which may be purulent, in the pleural cavity.

Ætiology. Hydropneumothorax or pyopneumothorax is the result of a perforation of the pleural cavity resulting from wound or disease of the chest wall; the rupture of some pulmonary lesion such as an abscess, tuberculous cavity, infarct, gangrenous condition, etc.; the rupture through the diaphragm into the pleural cavity of some inflammatory process due to malignant neoplasm of the œsophagus, stomach or intestine; the rupture of an empyema into the lung, or it may be caused by an empyema due to infection with some gas-generating micro-organism such as the *bacillus ærogenes capsulatus*.

Symptoms. The patient suffers from the symptoms of the causative lesion and at the time the rupture takes place complains of suddenly increased pain and difficulty in breathing. There may be a sensation of something giving way in the thorax. At times the symptoms of collapse, great prostration, rapid and feeble heart action and subnormal temperature, may be present. In such instances death may rapidly supervene. In other patients the symptoms of collapse become ameliorated but the ultimate prognosis, especially when tuberculosis is present, is bad. There are gradual loss of flesh and strength and dyspnœa, at times so severe that the patient insists upon sitting up in bed. There is a febrile movement; when pus is present the typical irregular curve of suppurative conditions is observed. The course of the disease in these latter instances markedly resembles that of empyema.

Physical Signs. *Inspection* and *mensuration* show one side of the chest to be larger than the other. The intercostal spaces may be obliterated and the respiratory movement of the thorax is slight. Upon *palpation* the vocal fremitus is found to be much diminished or absent. The *percussion* note above the fluid may be hyper-resonant, tympanitic or more rarely dull; below the fluid it is flat. *Auscultation* above the fluid reveals amphoric breathing or a feeble or absent vesicular murmur; the voice is usually bronchial or amphoric in quality. Below the level of the fluid voice and breathing are usually absent. If the ear is placed upon the chest just below the scapula of the affected side and the patient is shaken the splashing sound known as *succussion* will be heard, which is a pathognomonic sign of this condition. The so-called metallic-tinkle, the result of drops of fluid falling from the perforation into the fluid below, may be heard. With the ear at the back of the chest the clink of a coin placed against the front of the chest and tapped by another coin, may be heard. This sign is usually pathognomonic of hydropneumothorax although it may be present over bronchiectases.

Treatment. The patient should be confined to bed and fed upon a nourishing fluid diet. The pain may be so severe as to require the hypodermatic administration of morphine. When less severe it may be controlled by counter-irritation (see p. 667). The heart weakness may be relieved by stimulation by means of strychnine and alcohol. The dyspnœa may be lessened by allowing the patient to sit up in bed and by inhalations of oxygen. Marked dyspnœa and oppression may be relieved by tapping the chest above the level of the fluid. A needle of large calibre to which a rubber tube is attached should be used, but no aspirating apparatus. The pressure within the chest will cause the expulsion of the air during inspiration, and to prevent its re-entrance during expiration, the finger should be applied to the end of the tube, or this should be placed under water contained in a bottle arranged for the purpose. If the air continues to re-accumulate a drainage tube may be permanently fixed in the chest wall.

Aspiration of the fluid, if it is serous, may bring about improvement, but, when the fluid is purulent, is likely to result in only temporary relief.

Operative procedures may be employed with the hope of obliterating the pleural cavity.

HÆMOTHORAX.

Synonym. Hæmatothorax.

Definition. An accumulation of blood within the pleural cavity.

Ætiology. Blood in the pleural cavity may result from the rupture of an aneurysm, or from wounds of the blood-vessels of the neighboring parts. It may be due to malignant neoplasms of the lung or pleura or it may take place during the course of any of the hæmorrhagic diseases or, very exceptionally, during pulmonary tuberculosis, particularly in children.

Symptoms and *Physical Signs* are those of hydrothorax.

The prognosis. This depends upon the cause but it is usually very unfavorable.

Treatment is that of the ætiological factor combined with the aspiration of the fluid.

NEOPLASMS OF THE PLEURA.

While new growths of the pleura are uncommon, this membrane may be the seat of carcinomatous involvement. As a rule pleural carcinoma is secondary, having spread directly from a primary tumor of the lung; more rarely it may be metastatic as a result of neoplasms of other parts of the body—notably lung or breast.

Primary pleural sarcoma may occur and from it metastases may be deposited in other organs and tissues.

Symptoms and *Physical Signs.* Those of either carcinoma or sarcoma resemble the symptoms and physical signs of a chronic pleurisy and the differential diagnosis may not be made before the appearance of the cachexia typical of malignant disease, or of symptoms referable to the establishment of metastatic growths in other parts. The pulmonary symptoms accompanying pleural neoplasm are comparatively insignificant. Bloody effusion, if present, is suggestive of new growth and examination of the effusion may in rare cases reveal the presence of cells typical of carcinoma or sarcoma.

Treatment. This consists in the relief of the distressing symptoms by means of the aspiration of collections of fluid which interfere with lung and heart action, stimulation—alcohol, strychnine, etc., as indicated—and the maintenance of the patient's strength, in so far as is possible, by means of nourishing food. If pain is a feature of the condition morphine may be given hypodermatically.

The use of the Röntgen ray, radium or any of the vaunted anti-cancer sera may be undertaken but it is wise to inform the patient how little reliance may be placed upon these forms of treatment.

Non-malignant tumors of the pleura such as *lipomata* and *enchondromata* have been observed.

The pleura is also subject to *hydatid* or *echinococcus* disease. The occurrence of this condition is rare and usually the first noticed symptoms are those due to the presence of pleuritic effusion. The fluid is usually serous, more rarely purulent. The serous fluid of hydatid disease contains no albumin. The presence in the fluid of fragments of cysts and of hooklets is the only incontrovertible evidence of this condition

The treatment consists in aspiration to relieve the symptoms of compression of the lung. Surgical intervention is unsatisfactory.

DISEASE OF THE MEDIASTINUM.

Under this heading are classed the pathological conditions which may affect the contents of the mediastinal space, excepting affections of the heart, aorta, trachea and œsophagus.

Various types of tumors may develop in the mediastinum; of these the most important are:

1. *Carcinoma* and *Sarcoma*. These may be either primary or secondary, the sarcomata being more often primary than the carcinomata. The former begin in the remnant of the thymus gland, in the lymphoid structures which are numerous in this situation, or are secondary to sarcomatous growths of neighboring tissues; the mediastinal glands may also furnish a starting point for primary carcinomata. Secondary carcinomata develop as a result of primary growths in the breast, lungs, stomach, pleura or more remote structures; they are seldom of large size.

Symptoms. Small growths may not give any evidence of their presence; when symptoms are manifest they are those of pressure. Dyspnœa is early and constant, it may be due either to pressure upon the trachea, heart and great vessels, or upon the recurrent laryngeal nerves. In the latter instance hoarseness, loss of voice and the peculiar brassy cough, which is so characteristic of thoracic aneurysm, are also present. Pressure upon the thoracic vessels results in distention of the veins of the upper part of the body with accompanying coldness, cyanosis and œdema of the hands, and sometimes clubbing of the fingers. The distended veins may be tortuous and even almost varicose in appearance. There may be inequality of the radial pulses due to pressure upon the arteries. Pressure upon the sympathetic nerves causes pupillary inequality. Œsophageal compression results in dysphagia. Pleuritic and pericardial effusions may be present. In marked instances of the

affection, the growth may be so large as to nearly fill the thoracic cavity, the lungs and heart being pushed far out of their normal situations.

Tumors in the middle and posterior mediastina sometimes cause a cough, paroxysmal and whooping in character, from pressure upon the vagus nerve; with this cough there may be muco-purulent or blood-streaked sputum; dysphagia is sometimes marked but may be absent. Pressure upon the pneumogastric nerve is also said to cause cardiac palpitation, arrhythmia and attacks of faintness. Compression of the azygos veins may result in œdema of the upper abdomen and in transudation of serum into the pleuræ.

Growths which are secondary to tumors of the lungs or pleuræ are less apt to cause marked pressure symptoms but there is more frequently fluid in the pleural cavities and the cervical lymph glands may be enlarged. There is usually more or less cachexia, especially when there is associated involvement of the pleura or lung.

Physical Signs. Growths in the anterior mediastinum may cause a bulging or an erosion of the sternum. Upon *palpation* the vocal fremitus is sometimes exaggerated, sometimes diminished. Pulsation may be noted but is not of the expansile type which characterizes aneurysm. If the lesion is situated high in the mediastinal space it may be felt above the manubrium, if its situation is low it may be palpable in the xiphoid notch. The *percussion* note over the tumor is dull, the area of dulness corresponding in some degree in size and shape to that of the growth; it is usually somewhat irregular in extent. *Auscultation* over the dull area may reveal nothing, but at times the breathing and heart sounds are distinctly audible; a ventriculo-systolic murmur may be present due to pressure upon the vessels at the cardiac base. There may be a friction sound over the sternum when the arms are raised (Perez's sign).

Tumors of the middle and posterior portions of the mediastinum are evidenced by few physical signs other than dulness upon percussion and modification of the respiratory signs.

The diagnosis. Thoracic aneurysm resembles in many particulars the condition under consideration but in mediastinal disease the course of the affection is much more rapid and the symptoms of venous obstruction are much more pronounced; the cachexia is more marked and the tumor seldom possesses an expansile pulsation. Erosion of bone with its accompanying pain is more common in the case of aneurysm, the tracheal tug is often present and the characteristic diastolic shock may usually be both felt and heard; in tumor this is said to be never present. Mediastinal growths are more common in those of advanced years, except in the case of sarcoma, which may develop in youth, and may be associated with tumors of other parts; laryngoscopic examination may give evidence of tracheal narrowing.

The frequently associated pleuritic effusion may complicate the difficulties of the diagnosis of mediastinal disease as far as physical signs are concerned,

but examination of the fluid withdrawn by the exploring needle is often very helpful. The effusion is likely to be blood tinged or somewhat milky, due to the presence of fat. Large endothelial cells in the fluid are said to be characteristic of malignant tumors involving the pleural membrane. Aspiration of the fluid of simple pleurisy relieves the respiratory embarrassment but when a growth in the mediastinum exists this symptom persists.

The diagnosis of the type of the tumor may sometimes be made. Sarcoma is more likely to affect young subjects and is usually more rapid in its course than carcinoma. The latter may be associated with growths in the breast.

2. *Non-malignant tumors of the mediastinum* such as fibromata, dermoid and hydatid cysts, teratomata, lipomata and gummata, have been observed.

3. *Abscess of the mediastinum* is not especially rare; it is most common in the male sex and its most frequent cause is traumatism; the condition may also follow the infectious diseases, erysipelas or tuberculosis. In the latter instance the course of the affection is apt to be chronic. The abscess is most often situated in the anterior mediastinum, is evidenced by a throbbing pain and, if of large size, by dyspnœa. In acute instances there is an irregular temperature sometimes associated with rigors and sweats. The abscess may rupture through the diaphragm, the thoracic wall or into the trachea, bronchial tubes or œsophagus.

The condition may be suspected in the presence of abscess of the lung, empyæma, or if, after a history of injury or caries of the dorsal vertebræ, ribs or sternum, pressure symptoms with septic temperature develop. The physical signs are often indefinite; a fluctuating tumor may be palpable at the suprasternal notch or behind the ensiform cartilage. The employment of the aspirator in doubtful instances is justifiable.

In chronic abscesses the pus may undergo cheesy degeneration, and becoming inspissated, cause no evil result.

4. *Simple lymphadenitis* of the mediastinal glands may occur as a result of any inflammatory condition of the bronchi and lungs. The glands are most abundant in the posterior mediastinum and their involvement is characterized by hyperæmia, infiltration, swelling and œdema. The physical signs of the condition consist of dulness, often very difficult to detect, between the upper portions of the scapulæ. In marked instances there may be dulness over the upper sternum.

Tuberculous affections of the mediastinal glands may be primary or follow the simple type of lymphadenitis.

5. *Indurative Mediastino-pericarditis.* This condition occurs in several forms. It may be characterized by pericardial adhesions and marked increase in the fibrous tissues of the mediastinum; in a second type the pericardium is adherent to the neighboring structures but the mediastinal inflammation is slight; in still another variety the pericardium may be unaffected.

The condition is uncommon but is most frequently observed in young adults; it may be associated with a chronic diffuse peritonitis. The symptoms are those of pericardial adhesions with cardiac hypertrophy and dilatation; dyspnœa, cyanosis and general œdema are usual. Physical examination may reveal the presence of coarse, dry râles over the right border of the heart. These signs may be more easily detected if the patient's arms are raised.

6. *Mediastinal Emphysema.* In traumatism, fatal whooping cough and diphtheria, and after tracheotomy, air may force entrance to the mediastinum. The occurrence of the condition is said to be favored in the latter instance by the respiratory obstruction, the forced effort at inspiration and the operative division of the deep cervical fascia which, in the proper performance of tracheotomy, should not be separated from the trachea. The emphysema may involve the subcutaneous tissue. Air in the mediastinum also may be observed in pneumothorax and rupture of the lung.

The treatment of mediastinal disease is chiefly symptomatic although operative interference in a few instances has succeeded in removing tumors in this situation. Recovery is said to take place in 40 percent. of the cases of mediastinal abscess, but this figure should be raised since the statistics are those of the pre-antiseptic period. The treatment of abscess consists in free incision and drainage.

Favorable results have been reported to have followed the employment of the Röntgen ray in non-operable malignant growths, but while this form of treatment is always worthy of trial, too much should not be expected of it.

CHAPTER IX.

DISEASES OF THE URINARY SYSTEM.

ANOMALIES OF THE KIDNEY.

Normally the kidney, when the body is in the recumbent position, lies upon the psoas and quadratus lumborum muscles. The organ of the right side is situated somewhat lower—about ¾ of an inch (2.0 cm.)—than that of the left owing to the superimposed liver. Upon deep inspiration both kidneys descend slightly, but under normal conditions, as a rule, they cannot be palpated.

Abnormalities in Number.

Congenital absence of one or both kidneys may occur. In the latter condition, life is, of course, impossible, but the former state may exist unsuspected, unless the individual is for some reason subjected to physical examination and the elicitation of a tympanitic note over the site of the kidney and a failure to detect its presence elsewhere, leads to suspicion of the complete absence of the organ with its pelvis and ureter. In certain instances the remaining kidney may possess two pelves and ureters. Rudimentary ureters and congenital atrophy of one kidney are not uncommon.

Abnormalities of Size and Shape.

Hypertrophy of one kidney may be observed; unilateral atrophy has been mentioned above.

The lobulated kidney is not infrequent; here the normal fœtal lobulation persists, the lobes varying in distinctness, the fissures being in most instances shallow but rarely so marked as to separate the organ into distinct lobes.

Union of the two kidneys into a single organ of horseshoe, sigmoid or discoidal form is occasionally met. The tissue joining the two organs may be fibrous or of true kidney structure. In the horseshoe form the junction is usually at the lower poles of the organs, more seldom is it at the upper ends. These abnormally shaped kidneys are, as a rule, displaced downward and sometimes laterally. They often possess two pelves and at times three or four ureters. Fused kidneys have been removed under the impression that

they were single displaced organs. The mistake, as would be expected, ends in the patient's death with anuria.

THE MOVABLE KIDNEY.

Synonyms. Floating Kidney; Nephroptosis.

Normally the kidney is held in place by the peri-renal fatty tissue, the peritonæum anterior to the organ and the renal blood-vessels. If for any reason the kidney becomes displaced it may wander to almost any part of the abdominal cavity or it may be so slightly removed from its normal position as to be very difficult of palpation. In the former instance a fold of peritonæum, or mesonephron, connects the organ with the spinal column; certain clinicians would apply the term *floating kidney* only to this type of the condition.

Ætiology. Movable kidney is far more frequent in women than in men. It is predisposed to by hard muscular work, by tight lacing and by repeated pregnancies which cause a permanent relaxation of the abdominal wall. One woman in every five of those who have borne children has a displaced kidney, much more usually that of the right side, although the *post mortem* statistics are said to be one in fifteen; this difference is due to the fact that when the corpse is placed upon its back the organ slips into place. The displaced kidney is by no means limited to those who have given birth to children for it is not infrequent in nulliparæ as a result of absorption of the peri-renal fat, trauma or a congenital relaxation of the surrounding peritonæal folds. The greater frequency of displacement of the right kidney may be due to the presence of the liver and its pressure downward with each inspiration.

Seventy percent. of instances of movable kidney are associated with ptoses of other viscera—enteroptosis or Glénard's disease (see p. 379)—and are really a part of the general downward displacement.

Symptoms. In some instances the condition may give rise to no symptoms whatever but, on the other hand, there is hardly a mentionable symptom that cannot be attributed to a movable kidney. Reflex nervous symptoms are among the most common. Of these indigestion and gastric disturbances with pain and flatulence, cardiac palpitation and pain, and neuralgic pains referred to any part of the body, are very frequent. Gastric dilatation may occur and is considered by some to be a result of the displacement of the kidney, by others, to be a cause of the latter condition. Constipation is very often observed. Pressure of the displaced organ has been known to cause appendicitis. A dragging abdominal pain, especially evident while standing, walking or exercising in the erect position, is a common symptom, while irritability of the bladder and painful menstruation are not rare.

Gastric crises (Dietl's crisis) may occur and are characterized by chills, fever, abdominal pain, nausea and vomiting followed by a condition of col-

lapse; they have been attributed to temporary occlusion of the renal vessels by displacement of the kidney which twists these structures. During such attacks the urine may contain an excess of uric acid or of oxalates, or even pus and blood, and the organ itself may be tender.

Strangulation of the ureter may produce acute hydronephrosis of sudden onset and equally sudden ending.

The diagnosis of the condition is easily made and in all patients exhibiting such symptoms as those mentioned above, the importance of thorough abdominal palpation cannot be too strongly emphasized. The examination should be conducted while the patient is lying upon the back with the knees drawn up so as to relax the abdominal parietes. With the left hand under the lumbar region and the right over the hypochondrium just below the costal margin, bimanual pressure may reveal the presence of a firm rounded body which can be slipped from between the two hands. When impalpable by this method a deep inspiration may bring the lower segment of the organ into contact with the examining hand. The kidney is only slightly, if at all, sensitive to pressure of ordinary force; pronounced pressure may cause a characteristic sickening pain. The normally placed organ is not palpable except under extraordinary circumstances. Examination posteriorly may show a flattening over the normal site of the kidney and a more resonant percussion note than that upon the other side. The patient may be subjected to palpation similar to that described above while in the erect position.

Treatment consists in the employment of all means calculated to restore the patient's general health (see the section upon the treatment of neurasthenia). Thin patients in whom the peri-renal fat has been absorbed should be put to bed with the foot of the couch elevated six to eight inches so that we may have the aid of gravity in keeping the kidney in place after it has been restored by manipulation. The diet should be very nourishing and should contain a large amount of milk—at least two quarts (litres) daily—the object being to restore the retroperitonæal fat. If there is associated enteroptosis the diet should be that of gastric dilatation, frequent small meals of dry food, preferably peptonized. The thirst may be controlled by giving a quart (litre) of saline solution *per rectum* every three or four hours. Fat inunctions, for instance a mixture of codliver oil, one part to lanolin seven parts, should be employed. Cocoa butter and other vegetable fats may also be used. The treatment should be continued for at least six weeks. Stout patients should wear a properly fitting bandage and pad so constructed as to hold the kidney in place; where this is unobtainable an ordinary long "straight-front" corset laced tightly below and loosely at the top may often be worn with benefit. Strapping the abdomen with adhesive plaster so applied as to hold the kidney in place, is also to be recommended. All the above appliances should be put on while the patient

is either lying on the back with the hips elevated or is in the knee chest position. The administration of physostigmine salicylate in doses of $\frac{1}{100}$ of a grain (0.0006) twice daily is very advantageous; it is a most potent means of relieving the constipation and, where there is associated enteroptosis, it tends to correct this latter by stimulating the smooth muscle fibre of the digestive tract. Electricity is of comparatively little use as a stimulant to the musculature of the stomach and intestines, but may be employed. Massage is much more efficacious. The pain and other symptoms associated with Dietl's crises necessitate the application of heat to the abdomen and the hypodermatic administration of morphine.

Surgical treatment has been much vaunted as a means of cure in movable kidney and is certainly useful in properly selected instances. It consists in sewing the organ into its proper place and is followed by disappearance of the symptoms *only* when the nephroptosis is *not* a part of a general visceroptosis; here it is useless. The congested kidney should never be operated upon and the kidney which is the seat of pain (neuralgia) is not a proper subject for nephropexy for the pain will be increased by the procedure. In conclusion it may be said that anchoring the kidney when nephroptosis alone is present, may achieve a brilliant result but only under the conditions cited above. Faulty technique, however, may result disastrously, for multiple abscesses of the kidney, pyelonephrosis and psoas abscess have been known to follow the employment of contaminated ligatures. Nephrectomy is to be advised in grave cases only, and in these never except after the failure of other methods of treatment.

ALBUMINURIA.

Definition. Any condition characterized by presence of albumin in the urine.

Two main forms of the affection are recognized: *a*. Those associated with distinct lesions of the kidney or other portions of the urinary tract. *b*. Those in which such lesions are wanting.

In the former class we may make the following subdivisions: 1. Renal albuminuria due to congestion of the kidneys in its various forms. 2. Organic lesions of the kidneys such as acute and chronic nephritis, degenerations, suppuration and neoplasms of the organs. 3. Suppurative conditions of the pelves of the kidneys, the ureters, the bladder or of the urethra.

Of the forms of albuminuria occurring in the absence of definite renal lesions the most frequent is that which so often appears during the course of the infectious diseases, the so-called *febrile albuminuria*. Here the albumin results from slight alterations in the glomeruli brought about either by the rise in temperature or by the excretion of the toxins of the disease through

the kidneys. The albumin is usually small in amount, may be accompanied by hyaline or epithelial casts and disappears as the patient's condition becomes ameliorated.

Functional or physiological albuminuria is observed in certain subjects after violent exertion, cold bathing, over-eating—especially of nitrogenous food—mental emotion, etc. It may occur intermittently in poorly nourished children, especially those of neurotic heredity. In some instances it appears during the period of the onset of puberty, in others the albumin is present in the urine from time to time all through the life of the individual. When it is observed at regular intervals it is termed *cyclic albuminuria*. *Orthostatic* or *postural albuminuria* is still another type of the so-called physiological albuminuria and seems to occur as a result of the maintenance of an upright position of the body, at any rate its quantity appears to depend upon the amount of time spent in a standing posture. Usually in all varieties of functional albuminuria the quantity of the albumin is small, although at times large amounts are present. The quantity of the urine and its specific gravity remain normal but occasionally a few hyaline casts are found. The cause of the albuminuria is probably some slight change in the renal epithelium due to the influence of some irritant; in other instances some circulatory disturbance may be the causative factor although an increased tension of the pulse and an accentuated second aortic sound may be absent.

In many subjects the albuminuria persists without other symptoms for varying lengths of time and finally complete recovery ensues; in other individuals the albuminuria continues to occur at intervals, casts are present, there is arterial hypertension, the second aortic sound is increased in intensity and a true nephritis gradually makes its appearance.

Albuminuria due to disorders of the blood. In pregnancy albuminuria is frequently present and is usually due to some circulatory disturbance, although certain instances may be attributed to metabolic abnormalities; usually, however, there are changes in the kidneys in the albuminuria of pregnancy and casts are frequently to be found.

In anæmia, leukæmia, scorbutus, purpuric conditions, as well as in lead, mercury and syphilitic poisoning, albumin may occur in the urine as a result of the toxæmia.

Hyperglycæmia and cholæmia may be associated with the presence of albuminuria and, as a result of the excretion of inhaled chloroform or æther vapor, the urine after anæsthesia may contain albumin in small quantities.

In certain abnormal conditions of the nervous system albuminuria may occur, notably in epilepsy, cerebral hæmorrhage, meningitis, tetanus, cephalic injuries and in exophthalmic goitre.

ACUTE CONGESTION OF THE KIDNEY.

Synonym. Active Hyperæmia of the Kidney.

Definition. An acute transient engorgement of the blood-vessels of the kidney.

Ætiology. This condition is caused by the presence of irritant substances in the blood current, such as result from acute poisoning by certain drugs, notably, cantharides, copaiba, turpentine, cubebs, squill, phenol, creosote, arsenic, etc. It occurs also as the first stage of acute nephritis and probably also as a result of the presence in the organism of the toxins of the acute infectious diseases, although the researches of Mendelsohn have shown that the kidney of febrile disease is small and pale. Acute congestion also takes place in the remaining kidney after nephrectomy.

Pathology. The organ is swollen, hyperæmic and darker than normal in color; cut section shows a wider and darker cortex than the normal; the medulla is less red than normal and the line of demarcation between it and the cortex is indistinct. Microscopically the Malpighian bodies are swollen and their epithelial lining is the seat of cloudy swelling.

Symptoms. There may be lumbar pain and slight fever and acceleration of the pulse. The urine is scanty in quantity and in marked instances it may be suppressed. Its color is dark, its specific gravity high and albuminuria in greater or less degree, with a few hyaline and granular casts and perhaps a small number of red blood cells, is present. Dropsy and uræmic symptoms are absent.

The prognosis is favorable although repeated attacks may bring about an acute nephritis.

Treatment consists in confinement to bed and the limitation of the diet to milk. The congestion itself may be lessened by the application of dry cups and hot poultices to the lumbar region and especially by the administration of high rectal irrigations of hot (116° to 120° F.—46.5° to 48.8°C.) normal saline solution in quantity of 1 to 2 gallons (4 to 8 litres). These may be repeated several times a day and cause a rapid and marked increase in the amount of the urine and a diminution of the albumin. Hot packs are also useful; the bowels should be kept freely open by means of salines, and water may be freely drunk.

CHRONIC CONGESTION OF THE KIDNEY.

Synonyms. Passive Hyperæmia of the Kidney; Mechanical Hyperæmia of the Kidney; Passive Congestion of the Kidney.

Definition. A chronic venous engorgement of the blood-vessels of the kidney.

Ætiology. This condition results from chronic disease of the heart, lungs

or liver, which is associated with obstruction to the circulation and is in such instances, a part of a systemic venous congestion. Chronic renal congestion may also be due to tumors, the pregnant uterus or collections of ascitic fluid pressing upon the renal veins; more rarely is the condition caused by thrombosis of these vessels or of the ascending vena cava.

Pathology. The kidneys are enlarged and firm and the capsule is non-adherent. Cross section shows the medulla to be darker red than the cortex; the substance is firm and resistant and is coarse in appearance. The connective tissue of the organ is increased, the walls of the capillaries are thickened and their lumen is dilated; the tubal epithelium may be the seat of granular, fatty or hyaline degeneration. Sclerosis of the Malpighian bodies sometimes occurs.

Symptoms. Associated with those of the primary disease of which the renal congestion is the result, general dropsy is a prominent manifestation. It is first noticed in the feet and ankles whence it may ascend to the abdomen, the pleural cavities and the upper extremities. The urine is diminished in quantity, dark in color and of high specific gravity. Albumin is present in variable amount and with it may be associated hyaline casts, blood cells and desquamated tubal epithelium. The solids excreted by the urine are present in normal quantity. Uræmia in uncomplicated chronic renal congestion is a very rare occurrence.

The diagnosis is sometimes doubtful, the condition being often difficult of differentiation from chronic nephritis. Points which may aid in separation of the two conditions are the normal excretion of urea, infrequency of uræmia, less dropsy and albuminuria, and smaller number of casts, which are features of chronic renal congestion.

The prognosis is that of the primary disease; a chronic nephritis may result in a certain number of instances. Proper treatment may succeed in restoring the normal function of the kidney.

Treatment consists primarily in the proper management of the causal lesion (see the treatment of chronic endocarditis, hepatic cirrhosis, pulmonary diseases, etc.). The patient's general condition should receive attention, and rest, a light and easily digestible diet, and proper hygienic surroundings should be insisted upon by the physician. Iron, arsenic and strychnine are useful tonics. Digitalis and its substitutes (see p. 591) will usually increase the excretion of urine and may cause a disappearance of the albumin and casts and of the other distressing symptoms. Depletion through the intestinal tract should not be forgotten; here the hydrogogue cathartics, especially the salines, are indicated and the high rectal saline irrigation as described under the section upon the treatment of acute renal congestion is a very valuable adjuvant to the treatment. The dropsical condition may be lessened by prescribing a diet in which the chlorides are limited (see p. 694). Large pleural or abdominal collections of fluid should be withdrawn by aspiration.

URÆMIA.

Definition. A condition attributed to inadequacy of the renal function, occurring as a result of retention of the substances which normally are excreted through the kidneys, and often appearing in connection with nephritis and other states in which the urinary excretion is deficient or suppressed. There are, however, doubts to be cast upon this theory of the production of uræmia, for complete anuria does not always result in the appearance of this condition nor is there, in uræmic subjects, a constant increase of the urea in the blood or a concurrent diminution of the excrementitious solids of the urine. Many instances of uræmia are unaccompanied by an excess of nitrogenous excrementitious products in the blood, these substances have even been found in abnormally small quantities during uræmic attacks, and the uræmic syndrome, on the other hand, is often absent when the blood contains these supposedly toxic products in abnormally large amount.

It has also been determined that uræmia may occur when the nitrogen taken into the body is equivalent to that excreted, when less of the nitrogenous substances are cast off than are taken in and even when the output of nitrogen is far in excess of the intake; likewise, as above stated, uræmia may not develop when the retention of nitrogen is abnormally large. It would seem, therefore, that nitrogen retention, alone, has little to do with the causation of uræmia. The theory has recently been promulgated that the liver may be responsible for its development and that the diminished urea excretion is due to the fact that little is being formed within the body rather than that that already formed is being retained. This hypothesis is favored by the fact that frequently when the urea in the blood and urine is diminished, there is a corresponding augmentation in the amount of ammonia in these fluids. This would seem to point to the liver as the organ at fault, for it is here that, under normal conditions, most of the ammonia in the blood is changed into urea. In addition, the relative increase in the excretion of the purin bodies, which normally are changed in the liver to uric acid, over that of the latter substance, the relative increase in the uric acid excretion, this substance normally being converted into urea also in the liver, over that of urea, the occurrence of glycuronates, amido-acid compounds and of acetones, puts further onus upon the liver. Although we have much to learn concerning the metabolic functions of the liver, it may not be unfair to suppose that given an affection of the kidneys which interferes with their normal excretory power, the poisons with which these organs should, under ordinary conditions, cope are thrust upon the liver with the result that sooner or later, depending upon the organ's power of resistance, upon the concentration of the toxic substances and upon the length of the period during which they are present, the organ becomes insufficient.

Another theory which also lays the responsibility for the incidence of uræmia

upon the liver is that the normal kidney acts as a filter, and when diseased, this function becomes so altered that substances which formerly easily passed through the organ are now retained, while others, previously retained, are now excreted; among these last, elements may exist which are useful in the chemistry of the body and under normal conditions would have been further oxydized. Such substances are various derivatives of albumin. These being lost to the body, the organism must disintegrate more albumin in order to supply the lack, and this extra labor involves the liver again which ultimately becomes worn out, a condition of hepatic insufficiency supervening. It is probable, however, that the liver alone is not to be held responsible for the development of uræmia but that the condition really is the result of a general disturbance of metabolism.

Symptoms. These may be considered under several heads.

a. Those referable to the *nervous system.* One of the earliest of these is drowsiness which may appear suddenly or gradually; with it vertigo and headache, frequently in the occiput, are often present. The drowsiness may go on to coma, at times so marked that there is no response upon the part of the patient to a stimulus. Epileptiform convulsions may alternate with the coma, immediately follow the lethargy, without the intervention of coma, or appear independently and without warning. The convulsive movements vary from slight twitching to a paroxysm similar to that of a violent epileptiform seizure; the temperature is usually subnormal but sometimes a febrile movement is present. Acute mania and insanity with delusions are not infrequent; melancholia and various paralyses, hemiplegia or monoplegia, may be observed. The palsies may follow a convulsive attack or appear independently; no gross changes may be found at autopsy, but localized œdema of the brain may be present here and after death in convulsions or coma. Sudden blindness (uræmic amaurosis) may usher in a uræmic seizure or appear after a convulsion. It is usually transient, lasting but a few days; retinal changes are seldom seen. Uræmic deafness has been noted but is infrequent.

Pruritus is not rare and may be due to the elimination of toxic products through the skin; with it an erythema may be present accompanied by a frosty coating of urea crystals upon the skin.

Numbness and tingling of the extremities and muscular cramps, especially at night and in the calves of the legs, are less typical symptoms.

Respiratory Symptoms. Uræmic dyspnœa is common. It often appears suddenly at night, the attack markedly resembling that of true asthma, respiration being impossible while in the recumbent position. Dyspnœa due to cardiac dilatation and to pulmonary œdema may be associated with uræmia. In other instances the dyspnœa is continuous and in still others Cheyne-Stokes respiration may be present and persistent for considerable periods of time even when unassociated with coma.

Gastro-intestinal symptoms may be the first manifestations of uræmia and include anorexia, nausea and persistent vomiting; with these diarrhœa may be associated or the last may occur independently, being due to catarrhal or diphtheritic colitis. The tongue is frequently covered with a thick coating, the breath is foul and a stomatitis with swelling of the buccal, gingival and lingual mucous membranes may be observed.

Suppression of urine is often the first symptom but is not an essential one. It may be associated with a urinous odor of the breath, sweat and also of the vomitus, if emesis is present.

A rise of temperature is a frequent symptom but is by no means always noted.

The diagnosis of uræmia by means of the estimation of the amount of urea in the blood is somewhat uncertain for, as previously stated, the condition may not develop when the urea content of the blood is much increased and it may appear when the urea is present in abnormally small quantity. The examination of the blood and urine by means of cryoscopic and electric conductivity tests with the hope of being able to anticipate a uræmic attack, is more or less futile for it has been shown that uræmia often develops when the salt values in the blood are normal or subnormal, and that uræmia is by no means certain to appear when there is a marked augmentation of the salts in the blood and corresponding decrease in those of the urine. The quantitative determination of the urea excretion in the urine is of little value in predicting a uræmic paroxysm.

With a regard to the differential diagnosis of uræmic coma it may be said that a sudden attack of coma attended with diminished urine of abnormally low urea content is likely to be of uræmic origin. The coma of alcoholism or of opium poisoning may be mistaken for that of uræmia but in the former the pupils are dilated, in the second they are contracted while in the last condition they may be either the one or the other.

The prognosis. The occurrence of uræmia is always an unfavorable manifestation but is by no means always a fatal one.

Treatment. The treatment of the uræmic seizure will be dealt with in the sections devoted to the treatment of the nephritides and, in addition to the methods there suggested, the injection, after venesection, of a solution of sodium chloride (0.9 percent.) containing sodium bicarbonate or a solution of sodium citrate or phosphate may be advisable; an important consideration, however, is the prevention of the development of the acute paroxysm. This is to be accomplished by giving studious attention to the condition of the functions of the organs at fault, particularly the liver. Stimulation of this organ is contraindicated in the pre-uræmic state; on the contrary, rest is a paramount consideration. The over-worked liver should be spared as much as possible and likewise the general metabolism of the body should be regulated. The

liver is given a period of rest by the elimination from the diet of substances which are in the least irritative or stimulative, that is to say the patient should be put to bed and upon a regimen chiefly of milk, gruels and easily digestible semi-solids. This should be continued for a considerable period and at the same time elimination of the accumulated toxins is assisted by means of high rectal irrigations of hot normal saline solution. These should be given twice daily and should consist of two gallons (eight litres) of the solution at from 116° to 120° F. (46.5° to 49° C.) administered by means of a fountain syringe suspended from three to four feet above the patient and to which a soft rubber rectal tube is attached. When the liver has been thoroughly rested it should be stimulated to undertake its work once more by means of moderate doses of salicylic acid, sodium oleate, or if necessary, small doses of calomel. A pill consisting of 2 grains (0.13) of acid sodium oleate, 2 grains (0.13) of phenolphthalein, 5 grains (0.33) of methyl salicylate, and $\frac{1}{4}$ grain (0.016) of menthol will be found very useful. Of these four to eight pills may be given during the twenty-four hours, and through their influence the bile becomes more fluid, any tendency to hepatic hyperæmia is corrected and intestinal fermentation is to some extent prevented. While this treatment is being carried on the condition of the liver function, as evidenced by the patient's general state, and the composition of the fæces and urine, must be watched.

ACUTE NEPHRITIS.

Synonyms. Acute Bright's Disease; Acute Desquamative Nephritis; Acute Diffuse Nephritis; Acute Catarrhal Nephritis.

Definition. An acute inflammation of the kidneys involving the epithelial, vascular and connective tissues of these organs. The degree to which these various structures are affected differs in different instances.

Ætiology. Acute nephritis occurs most frequently as a result of one of the acute infectious diseases, scarlatina, diphtheria and smallpox being especially prone to be followed by this complication. The inflammation is observed less frequently in measles, enteric fever, cholera, yellow fever and dysentery, and is still more rare in acute articular rheumatism, tonsillitis, syphilis, acute tuberculosis and malaria. It may be observed in septicæmia, pyæmia and purpuric conditions. Exposure to cold and wet is a not uncommon cause; the acute congestion caused by the ingestion of chemical poisons such as potassium chlorate, phenol, mercury, arsenic, creosote, etc., may go on to acute nephritis; it may also occur secondarily to operations upon the kidney. Chronic skin diseases and burns, in the latter instance probably as a result of toxins absorbed through the burned surface or of poisonous substances developed in the organism, may be accompanied by acute kidney inflammation.

The condition is often seen in pregnancy and is now considered to be a

part of a general toxæmia rather than the result of pressure upon the renal vessels.

Acute nephritis, since the acute exanthemata and other infectious diseases are frequent in childhood, often is seen in the young. It is rare after middle life but may occur in adults before this period has been reached, depending in its frequency upon the incidence of its various causes.

Pathology. Both organs are equally affected and while in the milder types of the inflammation they may exhibit no appreciable gross change, in the severer forms they are more or less enlarged, sometimes even to twice their normal size and weight. The capsule is easily stripped off, the kidney substance is less firm than normal and its surface is smooth, mottled and may present hæmorrhagic spots. Upon section the cortex appears swollen and reddish and the inter-pyramidal portions of the medulla are also enlarged; from the cut surface dark blood oozes in considerable amount; this being removed the blood-vessels are seen to be congested and between them pale areas may be detected. The Malpighian bodies may be swollen, dark and congested; in other instances they are pale.

Microscopically, changes in the tubules, in the glomeruli and in the interstitial tissue may be found. The tubal epithelium is swollen and may be the seat of fatty or hyaline degeneration. The convoluted tubules may contain desquamated epithelial cells, leucocytes and red corpuscles and even hyaline or blood casts. The epithelium of the straight tubes is not affected but their lumens may be blocked by cells and degenerated matter which also may be found in the convoluted tubules.

The toxic cause of the nephritis affects the glomeruli earlier than the other portions of the kidney structure; their capillaries are distended with blood and their walls are often the seat of a hyaline degeneration; the epithelium of the glomeruli and of Bowman's capsule may be involved and the cavity of the latter may be distended with leucocytes and red blood cells. The connective tissue about the capsule may be increased and this, with the other changes, may affect the nutrition of the tubules to a marked extent

In mild instances of the disease the interstitial tissue is the seat of an exudation of serum and an extravasation of red and white blood cells; in the more marked inflammations the cells are greater in number and there is often an infiltration of small cells between the convoluted tubules and about the capsules. These changes may be localized in certain parts of the organ or generally scattered through its tissue

Symptoms. The onset of the disease may be sudden, especially in the type which follows exposure, or it may be gradual. The first manifestation is a puffiness under the eyes or œdema of the ankles. Rarely is the inflammation ushered in by a chill but its invasion may be marked by a convulsion in children. Nausea, vomiting and lumbar pain are frequent symptoms. The tempera-

ture is seldom high and in certain instances fever may be wholly absent unless it occurs as a symptom of the causative disease. The pulse may be slightly accelerated but an increase in tension is very constantly present and there is consequent accentuation of the second aortic sound.

Sweating is diminished and the urine is scant in quantity; entire suppression may occur as an early symptom. With the diminution of the urine there is usually dropsy, although this symptom may at times be absent. The œdema begins about the face and in the ankles, whence it extends to the trunk and upper limbs. It often involves the scrotum and prepuce as well as the peritonæal and pleural cavities. Œdema of the lungs or glottis may occur.

Anæmia is very constant and there may be hæmorrhages from the nose and into the skin during the disease.

The urine is very characteristic; it is scanty, perhaps but a few ounces in the twenty-four hours, high colored and of high specific gravity; its acidity may be increased and the sediment is often profuse, amorphous and reddish brown in color. Chemical examination reveals the presence of a considerable quantity of *albumin*, the urine often becoming almost entirely solid upon boiling; the albumin may be estimated to be 50 percent. or more by volume; by weight it is rarely over 2 percent. The albumin is made up of that contained in the extravasated blood and of the products of the degeneration of the lining of the tubules. The *urea*, while of high percentage, is considerably diminished in twenty-four hour amount. The microscope shows the sediment to be composed of blood cells, desquamated epithelium and casts of the uriniferous tubules; the latter are hyaline and granular for the most part, but casts to which blood cells or epithelium in various stages of degeneration, are attached, are common; these latter are rather characteristic of acute nephritis.

Uræmic symptoms (see p. 682) may appear at any time and add to the gravity of the disease; they are usually a late manifestation but may occur with the suppression of urine which marks the onset.

Retinal hæmorrhages have been observed but ocular involvement is not very common.

The course of acute nephritis varies; it may last but a few days or be prolonged for weeks; the kidneys may return to their normal condition or the disease may pass into the chronic type of the affection.

Complications are few but among those liable to occur may be mentioned pneumonia and empyæma resulting from an infection of the pleural transudate.

The diagnosis, in instances of well-marked symptoms, is easy, especially if we have the history of a primary disease. Patients who exhibit little dropsy and few or no other symptoms may possess kidneys which are seriously diseased as will be shown by urinary examination. The urine of the acute congestion of the kidneys may be distinguished from that of acute nephritis by its less amount of albumin, fewer hyaline and granular casts and the lack of blood

and epithelial casts. Sudden uræmic attacks may be the first evidence of the disease, especially in the type that is due to the toxæmia of pregnancy, although careful watching of the pulse for an increase of tension and of the urine for the appearance of albumin, will usually give warning of the impending danger.

The prognosis is variable. It is unfavorable in the patients whose symptoms persist for a month or more; if these gradually diminish after a week or two, the urine clears and the œdema gradually is lessened, recovery is probable. The prognosis in children is usually favorable. The occurrence of uræmic symptoms, of pulmonary œdema and of suppression of urine renders the outlook grave. In rare instances sudden death may take place.

Treatment. During the course of the disease rest in bed is an absolute necessity and the patient should be guarded against draughts and chilling of the body by warm covering; a night gown or pajamas of flannel are to be preferred to garments of cotton or linen. The ventilation of the room should be free, an apartment with a fire place being most suitable.

The diet should consist exclusively of milk during the acuity of the disease, for this substance is usually well borne, is easily digested and assimilated, and is nutritious. It also has the advantage that under its employment the albumin grows less in quantity and it gives less nitrogen to the blood than does meat. The quantity should be from 2 to 3 quarts (2 to 3 litres) during the twenty-four hours, given frequently in small amounts, for instance a glassful every two hours. It may be more agreeable to the patient when diluted with lime, carbonic or Vichy water or when it is flavored by the addition of a little coffee. Its diuretic action may be favored by the addition of 3 to 4 ounces (90.0–120.0) of lactose to the daily amount. Agreeable substitutes for milk are kumyss, matzoon, diluted condensed milk, vegetable—oatmeal, barley, arrowroot, etc.—gruels and meat broths. The last can hardly take the place of milk but may now and then be allowed if the patient chafes under a diet exclusively of milk. When there is clearance of the albuminuria the first additions to the regimen should be green vegetables, purée soups, bread and butter, cheese and eggs; later the white meats may be allowed but the red meats should be delayed for a considerable period. In connection with the discussion of the diet it would seem well to add a word concerning the management of the dropsy by means of the dechloridation treatment. There is in œdematious states a retention of the chlorides in the organism and this results in a transudation from the blood-vessels of serum and a consequent dropsy; if the diet contains still more chlorides the condition is augmented, consequently it is wise to eliminate these elements from the food as far as is possible; this is accomplished by excluding foods containing much salt, and forbidding the use of this substance in the preparation of the food or as a seasoning. This subject will be still further considered under the treatment of chronic nephritis.

With regard to beverages it should be stated that the patient is to be encouraged to take plenty of water, unless marked dropsy is present, either plain or carbonated; it may be flavored with fruit juices if more agreeable. The so-called cream of tartar lemonade is often well liked. It consists of a drachm or two (4.0 to 8.0) of potassium bitartrate added to a pint (500.0) of boiling water and flavored with lemon juice and a bit of lemon peel. It is most palatable when taken cold.

The lumbar pain at the onset may be relieved by the application of hot compresses or poultices, a sinapism, or even by wet and dry cupping or the actual cautery. These measures may, perhaps, have some influence upon the inflammation of the kidney. Wet cups should not be employed in children and the dry cups should not be allowed to remain long in one spot since it has been stated that if they remain too long stagnation of the blood within the capillaries takes place and consequently circulation in the kidney is delayed and the congestion is augmented rather than relieved.

The suppression of urine and the lack of perspiration, which may appear as an early symptom, necessitate the employment of the hot pack. This procedure is carried out as follows: A large-sized blanket is wrung out in water as hot as can be borne, wrapped about the patient and outside this a rubber sheet is applied. The patient is allowed to remain thus enveloped for from one to two hours, during which time hot drinks are given to increase the diaphoresis. By this means free sweating is induced and much of the toxic excrementitious matter which should have been passed off through the kidneys is eliminated. Other methods of producing diaphoresis are by administering a hot bath for fifteen or twenty minutes, after which the patient is wrapped in blankets; and by the vapor or hot air bath which is given by arranging the bed clothing so that an apparatus for generating steam or hot air may pass its product beneath. Any of these measures will cause the patient to perspire freely. At the end of the procedure the patient should be rubbed dry with warm towels, covered warmly and protected from draughts. The free diaphoresis is also very useful in diminishing the œdema and in warding off uræmia. Sweating is also to be advised in the treatment of this latter condition. Depletion through the bowels is also important in the management of the dropsy and the uræmia. Laxatives should be employed from the onset of the disease, at first to relieve the congestion of the kidney, later to assist in removing the dropsical transfusion. The salines are usually preferable to the vegetable purges; to children we may give the effervescing magnesium citrate; this is also useful in adults as likewise is the Hay method of administering magnesium sulphate; here 2 ounces (60.0) of Epsom salts are dissolved in an equal quantity of boiling water, when cool this is taken during the evening and by the following morning there will be a noticeable increase in the urine and several watery stools will have occurred. If acute uræmia is present.

even more active purgation is necessary, particularly if the patient is unconscious. Here we may employ elaterium in doses of $\frac{1}{4}$ of a grain (0.016) in solution or a drop or two (0.065–0.13) of croton oil diluted with a little olive oil may be placed upon the back of the tongue. Following this procedure free catharsis will be established. In the moderately severe instances of the disease it will suffice to secure a daily free movement of the bowels by means of moderate doses of any acceptable saline.

The administration of diuretics should be confined to patients in whom the urine is diminished and œdema is present, and attempts to increase the urine by means of drugs should be deferred until it is certain that this excretion cannot be sufficiently augmented by means of packs, hot baths and especially by copious high rectal irrigations of hot normal saline solution. The latter are among our chief reliances in uræmic and toxæmic states resulting from inflammations of the kidneys, they are stimulating, diuretic and greatly facilitate the elimination of poisonous substances from the system. They may be given two or three times daily, or oftener, if necessary. The quantity of saline should be 2 to 3 gallons (8 to 12 litres), the temperature should be from 116° to 120° F. (46.5° to 49° C.), the tube (a soft rubber rectal tube is essential) should be introduced as far as possible and the force of the flow should be gentle, the bag being elevated but three or four feet above the patient. This measure is usually superior to the administration of diuretic drugs, the latter often being irritant to the already impaired kidneys and possibly causative of anuria. Even water, which is an excellent diuretic, will tend to increase the dropsy, and consequently when we are desirous of diminishing the latter, should be taken in small quantities only. If absolutely necessary the alkaline diuretic drugs may be employed and the same is true of digitalis and strophanthus, the last two being admissible only when the blood pressure is low and there is tendency to cardiac weakness. Of digitalis the infusion is probably the most effective preparation, the dose being 2 drachms to $\frac{1}{2}$ an ounce (8.0 to 15.0); diuresis has been brought about by merely laying compresses wet in the hot infusion upon the abdomen of the patient. Caffeine and theobromine are useful at times.

It is probable that we have no means of directly causing a diminution in the albuminuria although we may give sodium tannate in daily doses of 40 to 60 grains (2.66 to 4.0) with this purpose in view. Quinine tannate—30 to 40 grains (2.0 to 2.66) daily—and tannalbin—30 to 45 grains (2.0 to 3.0) daily—have also been recommended. Strontium lactate, which will in certain conditions bring about a considerable diminution in the albumin content of the urine, is contra-indicated in acute inflammations of the kidneys.

Excessive arterial tension which may be a precursor of a convulsive seizure, especially in the nephritis of pregnancy, should be controlled by erythrol tetranitrate, gr. $\frac{1}{10}$ to $\frac{1}{2}$ (0.006 to 0.032) three to four times daily or glyceryl ni-

trate, gr. $\frac{1}{100}$ to $\frac{1}{50}$ (0.0006 to 0.0012) at similar intervals. Threatened uræmic seizures may also be warded off by the administration of hydrated chloral, gr. 3 to 5 (0.2 to 0.33) three times a day; this drug is especially useful in the albuminuria of pregnancy where there are restlessness, sleeplessness and other nervous symptoms and is also efficacious in the uræmic convulsion. Here it is best given by rectal injection, the dose for an adult being a drachm (4.0), and that for a child 10 to 30 grains (0.66 to 2.0). The heart should always be carefully watched for signs of weakness whenever chloral is given.

The treatment of a *uræmic attack* consists first in the control of the convulsion, if this is present. Chloroform should usually be given by inhalation to a degree sufficient to cause a cessation of the movements while the action of other measures has not yet begun. Chloral is also useful is suggested above. In order to strike at the cause of the seizure it is necessary to undertake measures with a view to bringing about an elimination of the toxic substances in the blood, the presence of which has resulted in the paroxysm, consequently all the channels of elimination should be opened by purges, diuretics and diaphoretics as suggested in preceding paragraphs. Pilocarpine is sometimes useful as an adjunct to other diaphoretic measures but should not be given if pulmonary complications or advanced degeneration of the heart muscle are present. Pilocarpine hydrochloride may be administered hypodermatically in doses of $\frac{1}{3}$ of a grain (0.02) and repeated in half to one hour if perspiration is not induced, or a fresh infusion made from a drachm (4.0) of jaborandi leaves and 4 ounces (120.0) of water may be injected *per rectum.*

In case of obstinate convulsions venesection may be practiced. If weakness supervenes hot normal saline solution should be given by hypodermatoclysis or by rectal injection. The latter is indicated in all cases as an aid to elimination of toxins and as a stimulant. Heart weakness and pulmonary œdema should be combated by means of cardiac stimulants, particularly strychnine, and in the latter condition oxygen inhalations may be employed.

The nausea and vomiting of acute nephritis may be controlled by restricting the diet temporarily, by the administration of cracked ice and if necessary gastric lavage may be employed. The ordinary anti-emetics also are sometimes useful; among the most effectual of these may be mentioned cerium oxalate in 5 to 10 grain (0.33 to 0.66) doses dissolved in milk with double the amount of sodium bicarbonate, tincture of iodine or creosote in minim (0.065) doses and dilute hydrocyanic acid.

Too much stress cannot be laid upon the importance of preventing intestinal fermentation. The occurrence of this is evidenced by the appearance of indicanuria and for its relief intestinal antiseptics are necessary. An excellent remedy consists of 5 grains (0.33) of bismuth tetraiodophenolphthaleinate combined in a capsule with 2 grains (0.13) of resorcinol. One of these capsules may be administered three times a day.

Hæmaturia seldom needs treatment by itself but if the renal hæmorrhage is marked we may give calcium lactate in doses of 20 grains (1.33) three times a day with a view to increasing the coagulability of the blood, and a powder containing 7½ grains (0.50) each of powdered cinchona and tannic acid has been suggested.

The complications should be treated as when occurring independently. The anæmia following the nephritis necessitates the administration of iron, of which one of the best forms is a solution of iron vitellin; this may be given in doses of ½ an ounce (15.0) three times a day to adults and half this quantity to children. In the latter excellent results are obtained from the official syrup of iron iodide in doses of from 7 to 10 drops (0.5 to 0.66) three times a day. In cardiac dilatation we may employ the means suggested in the section devoted to the treatment of this condition.

During convalescence all exposure should be avoided and a sojourn in a warmer climate is to be advised.

CHRONIC PARENCHYMATOUS NEPHRITIS.

Synonyms. Chronic Diffuse Nephritis; Chronic Desquamative or Chronic Tubal Nephritis; Chronic Bright's Disease.

Definition. A chronic diffuse inflammation of the kidneys characterized by epithelial, glomerular and connective tissue changes with exudation from the blood-vessels.

Ætiology. This form of chronic nephritis may result from the acute desquamative nephritis following the acute infectious diseases, exposure to cold, etc. It may occur as a sequence of chronic malarial poisoning, the abuse of intoxicating liquors, syphilis, chronic suppuration and tuberculosis, where it is usually associated with amyloid changes in the kidney. The disease is observed in children who have suffered from scarlatina but seems more common in young adult males than in older persons or females.

Pathology. Early in the disease the kidney is of the large white variety; the organ is considerably enlarged, its consistence is doughy or elastic, the capsule is thin and may be easily detached; the denuded surface is whitish with yellowish spots and there may be injection of the capillaries bounding the lobules and of the stellate veins. Section of the kidney reveals a thickening of the cortex, which is anæmic and white in comparison with that of the congested kidney. The microscope shows the epithelium to be swollen and the seat of a granular, fatty or hyaline degeneration; the glomeruli are enlarged and their capillaries and epithelium are degenerated. There is moderate increase in the connective tissue throughout the kidney; the tubules often contain granular and hyaline casts.

Later during the course of the affection the kidney becomes secondarily

contracted, small and mottled, and is now the seat more especially of a chronic diffuse inflammation. The capsule is thickened and adherent, the surface of the organ is granular. Section reveals a firm consistency, a narrowed and pale cortex and opaque areas of yellowish-white color consisting of fatty epithelium collected in the convoluted tubules. The changes in the interstitial connective tissue are more marked than in the large white kidney, the walls of the blood-vessels are thickened, the epithelium of the glomeruli and of the convoluted tubules is degenerated and the former may be obliterated by interstitial over-growth.

The so-called *chronic hæmorrhagic nephritis* is a form of the chronic parenchymatous type of the disease. Pathologically the chief distinction of this variety of the inflammation is the occurrence of brown foci, due to hæmorrhage, in the cortex both within and about the tubes. Associated with this manifestation are the conditions described above.

Hyaline degeneration of the vessels of the kidney is a frequent accompaniment of the lesions of chronic diffuse nephritis. Arterial degeneration throughout the body and cardiac hypertrophy may be mentioned as frequently co-existing.

Symptoms. The symptoms of an acute nephritis may, without distinct separation, merge into those of a chronic parenchymatous nephritis, or the disease may begin gradually with indefinite symptoms of increasing weakness or indigestion, until the suggestive paleness of the skin and the œdema of the lower eyelids and of the feet draw the attention to the possibility of renal disease.. The dropsy steadily ascends the legs but in the early stages may be only slight on rising in the morning. As the day wears on it increases. Ultimately the œdema becomes general, affecting the subcutaneous tissues of the entire body; it is often especially marked in the penis and scrotum. The serous sacs may fill with fluid and pulmonary and glottic œdema may appear with little or no warning and result in death.

Anæmia is constant and characteristic, and results in a pasty color of the skin which, with the accompanying puffiness of the facies, often gives a very certain clue to the diagnosis. Accompanying this symptom is a gradually increasing weakness. Dyspnœa is frequent, resulting from the interference with respiration due to the presence of pleural transudate, to the general weakness of the patient or to the cardiac condition. The heart is at first hypertrophied, more especially its left ventricle; later dilatation may ensue. There is increase in the tension of the pulse with an accentuation of the second aortic sound.

Nausea and vomiting with intestinal fermentation due to improper action of the liver, are common; colonic ulcerations may occur and terminate in death.

Uræmic convulsions are not observed but headache, dizziness, insomnia and stupor, followed by delirium or coma and ending fatally, are not rare.

Retinal changes are less frequent than in chronic arterial nephritis but the so-called albuminuric neuro-retinitis may be present and cause dimness of sight and diminution of the visual field.

The urine is diminished in quantity in the earlier stages but later it may be nearly or quite normal in amount; when scanty it is of high specific gravity and dark in color and often turbid. On standing an amorphous precipitate consisting of urates, blood cells, casts, granular detritus, etc., appears. The albumin content is often large, 3 to 4 percent. by weight, and usually is in greater quantity in the urine passed during the day. The total content of urea is diminished. The microscope reveals the presence, first of epithelial casts, later granular casts appear and still later those of the fatty and hyaline types; red blood cells, leucocytes, epithelial and granular debris are often to be found. Indicanuria is often present and indicates an auto-intoxication due to insufficient elimination on the part of the liver and intestine. The resulting toxins act upon the already impaired kidney to its further detriment.

The diagnosis in certain instances is very simple, the pallor and puffiness of the face being characteristic, the saying "large white patient, large white kidney" proving oftentimes true. When the examination of the urine shows a diminished amount, increased weight, diminished urea, considerable quantity of albumin and casts as described above, the problem is not a difficult one, particularly in connection with a typical history. It is often difficult to distinguish between the large white and the small white or mottled kidney; the differentiation is fortunately of no great practical importance. Points in favor of the small kidney are an increased amount of urine, lower specific gravity, less albumin and a history of long duration. The kidney of hyaline degeneration is usually accompanied by enlargement of the other viscera, there is less œdema, albumin and casts are more scanty and cardiac hypertrophy, retinal involvement and uræmic symptoms are not present.

The prognosis is always unfavorable but life in comparative comfort may be continued for a number of years, the symptoms disappearing and the albuminuria clearing to a considerable extent; unfortunately, however, sooner or later the œdema and other manifestations reappear and the patient finally dies from uræmia, exhaustion, heart failure, pulmonary œdema or secondary inflammations of the serous sacs.

It is rare to see recovery take place after the disease has lasted for a year but this circumstance may occur, particularly in children.

Patients whose urine is markedly diminished, who excrete but little urea and a persistently large quantity of albumin, and in whom cardiac, arterial and retinal degenerations are present, have little chance of recovery.

Treatment. With regard to prophylaxis, too great stress cannot be laid upon the importance of daily qualitative and quantitative examination of the urine in all the acute infections; this should be continued until recovery.

If the kidney is damaged the urine should be watched with particular care for the occurrence of indican which by its presence shows that there is an auto-toxæmia due to the non-elimination of intestinal poisons through the liver. These toxic substances are most deleterious to the kidneys and should be gotten rid of as quickly as possible by hastening their elimination by purging and the process of high intestinal irrigation with normal (0.9 percent.) salt solution. Their further formation should be prevented by regulation of the diet—cutting off the carbohydrates—and the administration of intestinal antifermentives such as bismuth naphtholate (orphol) or tetraiodophenolphthaleinate, 5 grains (0.33) of either of which may be given three or four times daily.

The treatment of chronic parenchymatous nephritis is first of all dietetic. While a strict milk diet formerly was considered an essential, the work of von Noorden and others seems to prove that a mixed regimen may be allowed, at least in certain instances, without detriment and certainly to the great comfort of the patient. The diet should be regulated upon the data obtained upon the examination of the urine and upon the amount of œdema. An abnormal quantity of urates in the urine indicates too much proteid; indicanuria shows that intestinal fermentation is present as a result of too free ingestion of starch and sugar; consequently the feeding should be arranged with a view toward maintaining a proper balance between the intake and the output. When the dropsy and albuminuria are marked the diet should be limited to milk or buttermilk, preferably diluted with carbonic, lime or Vichy water (fermented milks such as kumyss or matzoon are usually better borne than plain milk if the period of administration is long), dry toast, zwieback or biscuits; if the œdema and albuminuria are but slight we may be more liberal, allowing in addition to the above, vegetables, especially those whose iron content is small, cereals, fruits and small amounts of meat, white or red. Irritating condiments must be forbidden; asparagus, which formerly was considered as something to be totally excluded from the diet of the nephritic, has been proven to be harmless.

While dealing with the question of diet the important subject of the treatment of dropsical conditions by means of *dechloridation*, or the restriction of salt from the food, should be considered. In chronic parenchymatous nephritis the kidneys excrete but a small amount of chlorides and consequently these substances, being taken into the organism in greater quantity than they are eliminated, accumulate within the system. This retention results in dropsical conditions.

Chloride retention in nephritic patients varies greatly in different instances, but whether transient or permanent, slight or intense, it is governed by the impermeability of the kidneys to sodium chloride; therefore, the indications as to duration and strictness of the limitation of the chloride intake depend

upon the condition of the patient in hand. Fortunately we have a very simple means of estimating these indications, namely, by daily weighing of the patient. By carrying out this procedure the physician possesses a method of following step by step the effect of the prescribed diet. Loss of weight signifies diminution of the œdema. A sample diet containing but a small amount of chloride is appended. Bread made without salt, 10 ounces (300.0), beef, 10 ounces (300.0), potatoes, 10 ounces (300.0), cooked in about 2 ounces (60.0) of unsalted butter. For drink, a quart (1 litre) of water with 6 ounces (180.0) of coffee and, if desirable, 10 ounces (300.0) of wine, may be allowed. Daily weighing of the patient enables us to follow from day to day the progress of the chloride elimination and to regulate the rigorousness of the treatment in accordance with the chloride retention, and in the intervals of marked chloridæmia we have a means of testing the impermeability of the kidneys to sodium chloride. Thus we can avoid unnecessarily depriving the patient of salt and we are able to detect at once any threatened retention of chlorides which we may avert, or at least moderate, by insistence upon a regimen lacking in salt.

The administration of theobromine in doses of 10 grains (0.66) three times daily in connection with the dechloridation treatment is an important adjuvant. This drug increases the effect of the restricted diet but cannot replace it; by prescribing throbromine together with a diet low in chlorides it is possible to free a nephritic patient from the distressing dropsy so often observed in kidney lesions.

The albuminuria of chronic parenchymatous nephritis may be greatly reduced by putting the patient to bed and at the beginning of treatment this measure is always advisable; later when the more distressing symptoms have become ameliorated the sufferer may be allowed up and may even take moderate exercise. Fresh air and out-door life are particularly necessary in this disease. The clothing should be of linen mesh or wool next the skin for it is most essential that chilling of the surface shall be prevented, since cold interferes with the eliminatory action of the skin and may produce an acute exacerbation of the chronic renal inflammation; even suppression of urine has been known to follow exposure to cold and wet.

The administration of strontium lactate is often an efficient measure in reducing the quantity of albumin excreted in the urine but this drug should not be employed when any acute process, as evidenced by the presence of epithelial or blood casts or of red blood cells, is present. The proper dosage of this agent is from 30 to 40 grains (2.0 to 2.66) daily, well diluted.

The anæmia which may be less extreme than the paleness of the skin would lead one to suspect, necessitates the exhibition of iron. The dropsy may be diminished, in addition to its treatment by regulation of the diet as discussed in a previous paragraph, by the means suggested under the treat-

ment of acute nephritis. Aspiration of the pleural and peritonæal cavities is often necessary. The extreme tension of the skin of the lower limbs resulting from marked œdema may be relieved by making numerous punctures with a needle or by incisions of considerable size in the region of the ankles. The so-called Southey's tubes may also be used. The tube consists of a fine trocar and canula, the former being withdrawn after the puncture is made and the latter left *in situ*. To its outer extremity a fine rubber tube may be attached and led to a vessel which will collect the serum. All the surgical procedures mentioned above should be carried out with the utmost precautions as to asepsis for septic infection added to the primary condition is a serious matter.

The œdema of the glottis, which sometimes appears, should be promptly scarified or if this fails intubation or tracheotomy should be practiced.

The uræmic, cardiac and other symptoms and complications should be treated as when occurring in acute nephritis.

Surgical treatment by means of *decapsulation of the kidney*, if applicable in any form of chronic nephritis, may possibly benefit the patient's condition in this type of the disease by establishing a collateral circulation which will relieve the kidney of its accumulated toxic substances.

The operation consists in exposing the organ and peeling off the capsule in its entirety to within a short distance of its junction with the renal pelvis. It is a useless procedure except in rare instances of chronic parenchymatous nephritis.

CHRONIC ARTERIAL NEPHRITIS.

Synonyms. Chronic Interstitial Nephritis; Contracted Kidney; Cirrhosis of the Kidney; Renal Sclerosis; Gouty Kidney.

Definition. A chronic sclerosis of the blood-vessels of the kidney occurring as a part of a general arteriosclerosis and connective tissue inflammation of the viscera. It is not properly an inflammation of the kidneys but a part of a generalized sclerotic process.

Ætiology. Being merely a localized manifestation of a sclerosis affecting all the arteries of the body, the causation of chronic arterial nephritis, perhaps more properly denominated chronic arterial degeneration of the kidneys, is identical with that of arteriosclerosis in general. It is rarely seen in individuals under forty years of age and is more common in males, because of their more frequent exposure to the direct ætiological factors of the degeneration.

Gout, syphilis and chronic plumbism are important causes and a history of excessive use of alcohol and over-eating, especially when associated with life at high mental and physical tension, is very frequently met in patients with this affection. It is probable that the disordered metabolism from which

such individuals suffer is responsible for the occurrence in the circulation of certain toxic substances which by their action cause an over-growth of the arterial connective tissue.

Certain families possess a tendency to early arterial degeneration and this hereditary influence may be set down as one of the factors which produce this form of kidney lesion.

The chronic passive congestion of the kidneys which occurs in cardiac lesions predisposes to arterial degeneration in these organs, as also does renal lithiasis, and arterial nephritis likewise occurs as a part of the ordinary senile connective tissue changes

Pathology. The morbid changes occurring in this affection are not confined to the kidneys, and the involvement of these organs usually does not take place until a considerable period after the pathological process has begun in the general arterial system. The essential lesion is a thickening and connective tissue degeneration of the intima of the arteries throughout the body, associated with increase in the connective tissue of the viscera. The kidney of chronic arterial degeneration is the small, red granular kidney with thickened and adherent capsule. The organ may be shrunken to only half its normal size, its surface, especially after removal of the capsule, is uneven, granular, dense and tough, and its color is often red in contradistinction to the yellowish-white tinge of the kidney of the stage of contraction of chronic parenchymatous nephritis. Cysts containing watery or viscid fluid are often observed at the surface of the organ; these vary in size from that of a pin-head to that of a good-sized marble.

The kidney substance is dense and resistant to the knife. Section reveals a great decrease in the width of the cortex and a less marked shrinkage of the medullary substance; the walls of the arteries are much thickened and the Malpighian bodies shrunken; cysts may be present. The pelvis may be normal in size, enlarged or decreased. The surrounding fatty tissue is often much increased in amount.

Microscopic examination shows an increase in the connective tissue of the walls of the blood-vessels and an over-development of the interstitial connective tissue of the organ itself; this tissue is increased at the expense of the tubules and blood-vessels which it tends to obliterate. Certain parts of the organ may show marked changes such as those described above, while in others there is but little interstitial over-growth. Certain of the tubules appear to be normal while others may be dilated, shrunken and obliterated or even entirely replaced by new connective tissue. The epithelial lining of those which remain may be in normal condition or granular; the tubes may contain hyaline casts. The Malpighian tufts are enclosed by connective tissue and often are shrunken and atrophic. The walls of the arteries are in a condition of marked sclerosis, the intima is thickened and the media is also affected, its muscular

tissue being encroached upon by the increase in its connective tissue elements. There is also over-growth of the interstitial tissue of the adventitia. As a consequence of these changes the arteries become dilated and twisted and the hyperplasia of the connective tissue of the organ itself may result in their final obliteration.

Associated with the changes in the kidneys are those of general arteriosclerosis, sclerotic changes in the liver, spleen, lung, heart etc., and as a result of the heightened blood pressure and increased difficulty in forcing the blood through the diseased arteries, hypertrophy of the last organ, especially of its left ventricle, is frequent.

The retinal abnormalities which are often associated with arterial nephritis are merely a part of the general arterial degeneration, as a result of which hæmorrhages due to rupture of the degenerated arterial walls may occur.

Symptoms. The diagnosis of this condition is often unsuspected until the appearance of a terminal uræmic attack, but the careful and thorough clinician may make frequent early diagnoses upon the occurrence of an accentuated aortic second sound; in other instances the condition of the retina (see p. 797) as revealed by ophthalmoscopic examination, leads to the first suspicion of the presence of arterial nephritis. Urinary examination, suggested by the auscultation of the heart and inspection of the retina, reveals the following changes: In quantity this excretion is increased, the polyuria being due to the damaging effect of the inflammation upon the epithelial cells of the tubules which normally absorb water from the urine which has passed from the glomeruli. The acidity is low, as is also the specific gravity, as a result of the low excretion of total solids; the color is light. The constant low specific gravity is an important feature and urines so characterized are always to be considered suspicious. The albumin content is small, often merely a trace, and even this may be absent in specimens passed in the early morning. Casts, chiefly hyaline, sometimes granular, are usually present but thorough sedimentation of the urine is often necessary for their demonstration. The urea excretion is diminished; the total quantity passed in twenty-four hours may be as small as 20 or 30 grains (1.33 to 2.0)—the normal amount being about 500 grains (33.0)—just before an attack of uræmia. The urea content, as well as the amount of albumin present, varies with the patient's diet and the amount of exercise taken.

The patient often complains of a progressive physical weakness and various visual disorders may occur early in the disease. Retinal hæmorrhages are not infrequent and retinitis or papillitis may be observed. The resulting impairment of sight is permanent but the amblyopia and amaurosis which sometimes appear may be merely temporary. Tinnitus, impairment of hearing and vertigo are not uncommon.

Dropsy is rare in this form of nephritis but slight œdema of the ankles may

be observed, and the pasty pallor of the skin so characteristic of chronic parenchymatous nephritis is absent; the skin, may, however, be pale as a result of the anæmia accompanying the disease. Eczema with distressing pruritus is not uncommon. Nose-bleed and subcutaneous hæmorrhages are frequent and are due to the tendency of the degenerated blood-vessels toward rupture.

Hypertrophy of the left ventricle is quite constant and is evidenced by an accentuation of the second aortic sound, a physical sign upon which alone the diagnosis of chronic arterial nephritis may be made in many instances. The pulse is of increased tension and there is thickening of the walls of the artery. It is to overcome this increased resistance to the flow of the blood current that the ventricular hypertrophy takes place. Dilatation finally supervenes and with it there is often a relative mitral insufficiency evidenced by an apical ventriculo-systolic murmur transmitted into the axilla; when the dilatation over-balances the hypertrophy the signs and symptoms of uncompensated heart disease supervene, such as gallop rhythm, dyspnœa, palpitation and vertigo.

Disorders of respiration due to the co-existent interstitial inflammation in the lungs—chronic bronchitis and emphysema—such as dyspnœa on exertion and cough, are not rare. Sudden attacks of marked dyspnœa, especially at night or early in the morning, and due to sudden attacks of arterial contraction, may occur; œdema of the glottis or of the lungs takes place at times. Pleural effusion is seldom seen. Cheyne-Stokes respiration may be observed as a late symptom.

Symptoms referable to the digestive system are common. The tongue is often coated and the breath may possess a uriniferous odor. Dyspepsia of various types is frequent and uncontrollable and even fatal vomiting and diarrhœa have been observed. Fermentation in the small intestine is evidenced by the presence of indicanuria. The resulting toxic substances, particularly lactic, butyric, oxybutyric and acetic acids, increase the tendency to the production of sclerotic changes in the arterial and other systems.

Cerebral manifestations, headache, neuralgic pains and apoplectic seizures due to intracranial hæmorrhages, are frequent.

Uræmia is a late symptom and often a terminal one; it is usually accompanied by a rise in temperature and may be evidenced by headaches, vertigo, convulsions, stupor or delirium.

The complications are essentially the same as those of chronic parenchymatous nephritis.

The diagnosis may not be made until the patient has reached the autopsy table but should any symptoms have arisen during life suggesting the need of urine examination, the characteristic findings at once suggest the presence of the disease. The diagnosis is often made by the ophthalmologist and the presence of continued high arterial tension or an accentuated second aortic sound

should always lead to suspicion. Differentiation from the later stages of a chronic parenchymatous nephritis may be difficult; the history will help us here and the presence of fatty and granular casts is more characteristic of the latter condition.

The prognosis as to recovery is distinctly unfavorable but the existence of the disease is not at all incompatible with the prolongation of life for years and does not interfere with the patient's pursuits so long as these are properly regulated. After the appearance of uræmic symptoms the probability of betterment is little, but under proper treatment, even patients who have not been seen until the occurrence of these manifestations, may be relieved to a marked extent. Unfavorable symptoms are convulsions, delirium, coma, persistent vomiting and diarrhœa.

Treatment. The patient should lead a quiet life both mentally and physically and all conditions which are likely to put any excessive strain upon the circulatory system or the kidneys are to be carefully avoided. Moderate exercise should be advised and with it a life in a temperate climate, or, if the latter is impossible, careful avoidance of wetting the feet, of exposure to extremes of temperature and to dampness must be insisted upon. Clothing such as that suggested under the treatment of chronic parenchymatous nephritis should be worn. Tobacco and alcohol are not permissible but the moderate use of tea and coffee need not be discontinued.

The proper diet is a mixed one so regulated as to maintain the patient's nourishment without physiological improvidence. It should contain enough but not too much of the carbohydrate element and also sufficient proteid in readily oxydizable form (beef particularly). The proper proportion of starch and proteid may be ascertained by chemical examination of the urine, too plentiful carbohydrates (especially too much sugar) being evidenced by indicanuria accompanied by intestinal fermentation, and proteid in too large amount by a superabundance of urates and uric acid. In general the regimen appropriate in chronic parenchymatous nephritis is suitable here. The diet lacking in chlorides should be prescribed when dropsical conditions are present. Moderation in eating as well as in all other things must be insisted upon. A moderate amount of water should be taken, one quart (one litre) daily is usually sufficient; excessive water drinking is to be discouraged since it increases the fluid elements of the blood and consequently raises blood pressure, and its excretion puts additional work upon the impaired kidney. With regard to the kind of water little is to be said; practically the only essential is that it should be pure. The much-vaunted lithia waters are quite suitable, not because of the infinitesimal amount of lithia which they contain but because they are, as a rule, pure; the same may be said of nearly all other mineral waters. Even though benefit is not to be expected from drinking the waters, a yearly sojourn at such resorts as those at Poland, Maine, Saratoga,

etc., and similar ones in Europe, is advisable when the circumstances of the patient permit.

A daily warm bath should be taken, but just as chilling the body through exposure to the inclemencies of the weather may precipitate a uræmic seizure and should consequently be avoided, the cold bath, and especially the prolonged sea bath, may bring about this most undesirable occurrence. Turkish and Russian baths are often beneficial but from these the cold plunge should be eliminated.

A free movement from the bowels should be secured daily by means of saline laxatives or waters such as Hunyadi Janos, Apenta, etc., and an occasional course of fractional doses of calomel may be prescribed to advantage, particularly if intestinal auto-intoxication, due to fermentation and lack of elimination, is present. The administration here of intestinal antiseptics is also necessary as under like circumstances in chronic parenchymatous nephritis.

The anæmia necessitates the use of tonics, such as iron, quinine, arsenic and strychnine, but it must not be forgotten that iron may be harmful in the kidney of chronic arterial degeneration; it is said to cause headache, interfere with elimination and predispose to the occurrence of uræmia. On the other hand tincture of iron chloride is considered by some clinicians of marked value in the anæmia of chronic nephritis; it is recommended in doses of 30 to 60 minims (2.0 to 4.0) three times a day and is said to have the additional effect of lessening arterial tension. In moderate anæmia of chronic arterial nephritis the elixir of iron, strychnine and quinine of the National Formulary is an excellent preparation.

One of the most important considerations in the treatment of this disease is the opening of the arteries by means of the vaso-dilator drugs. By this measure we relieve the hypertrophied and over-worked heart and increase the blood supply, and consequently the nutrition, of every organ and tissue of the body. The nitrites are most useful here especially erythrol tetranitrate—which though a nitrate has an analogous action to this series of drugs; this agent when given in doses of $\frac{1}{2}$ a grain (0.032) achieves its maximum effect in about one hour; this effect persists for about six hours, consequently by giving four doses during the twenty-four hours we can keep the patient's arteries properly open. Tolerance to this drug is not easily established and its administration can be continued for long periods. It is best prescribed in the form of pills with kaolin or lycopodium as an excipient for if it is mixed with an oxydizable substance it will explode. Glyceryl nitrate is second in its usefulness only to erythrol tetranitrate but is inferior in that its effect is less persistent, lasting but from two to three hours. It must, then, be given at frequent intervals in order that its action shall be continuous. The dose varies with different patients and should be regulated according to the effect produced. One should

usually begin with $\frac{1}{100}$ of a grain (0.0006) which may be repeated at frequent intervals, the patient being watched meanwhile for toxic symptoms such as dizziness, flushing of the face, a feeling of fulness in the head and headache. Sodium nitrite is another useful drug of this class but is difficult to obtain in a state of purity, being almost always contaminated by nitrates. Its maximum effect is reached in two hours and lasts from four to six hours; its dose is from 3 to 5 grains (0.2 to 0.33). In employing the vaso-dilator drugs the object is to relieve the heart by reducing the arterial tension and to lessen the tendency to arterial rupture. It is, however, necessary to provide against too great lowering of the blood pressure for, if this happens, œdema and effusions into the serous sacs are likely to take place.

The already increased amount of urine of the early stages renders the use of diuretics unnecessary but late in the disease they may be employed as in chronic parenchymatous nephritis.

Hæmorrhages are treated as when occurring in other conditions; apoplectic attacks necessitate the application of an ice helmet, venesection if the blood pressure is high, the administration of potassium iodide in the later stages and the employment of the other measures suggested under the treatment of apoplexy. Bleeding from the mucous membranes should be treated according to the usual methods. Benefit is usually gained by giving calcium lactate in doses of 20 grains (1.33) three times a day for a short period. Other complications should be managed as when occurring independently.

Uræmia is handled according to the methods suggested under the treatment of acute and chronic parenchymatous nephritis.

In other regards than those mentioned, the treatment of chronic arterial degeneration of the kidneys is identical with that of arteriosclerosis in general (q. v.).

The treatment of this form of nephritis by means of decapsulation of the kidney is entirely useless as may be plainly seen from a consideration of the nature of the disease. The general arterial system being profoundly affected treatment directed only to the kidneys must of necessity be of little avail.

THE AMYLOID KIDNEY.

Synonyms. Lardaceous Disease; Waxy Degeneration.

Definition. A chronic degenerative process occurring in the kidneys, and in other organs and tissues at the same time, and characterized by an infiltration of the organ with an albuminous substance which becomes mahogany-brown in color when wet with tincture of iodine.

Ætiology. This affection occurs as a result of chronic suppurative processes especially those involving bone, such as ostoemyelitis of pyogenic, syphilitic or tuberculous origin; in tuberculosis of long standing; in syphilis; in gout,

chronic plumbism and leucæmia. It is very frequent in Pott's and hip-joint disease.

Pathology. The amyloid kidney is large, pale in color and of smooth surface. If the condition is uncomplicated by interstitial changes, the capsule is not adherent; the stellate veins may be plainly visible. On section the cortex is seen to be thickened, pale, firm, and may present a characteristic lustre; the glomeruli are prominent. The pyramids are not enlarged and are deep red in color. Upon smearing the cut section with tincture of iodine the mahogany-brown coloration above alluded to appears; in later stages and when the amyloid change is associated with interstitial increase of connective tissue, the kidney is small, its capsule is adherent and its cortex narrowed. The hyaline degeneration first involves the Malpighian tufts and the blood-vessels; later the tubules may become affected. Microscopically the degeneration is seen to involve both the interna and the muscular coat of the blood-vessels, these are so thickened as to, in certain instances, wholly obliterate the lumen of the vessel. The infiltration of the straight tubules begins in the *membranæ propriæ* and the tubules may contain waxy casts. The epithelium may be in a state of fatty degeneration and glomerulitis and thickening of Bowman's capsule are often present.

Symptoms. These are not particularly characteristic and are apt to be masked by those of the primary disease. The *urine* is pale in color, increased in quantity and low in specific gravity. Albumin is usually present, often in large amount; globulin also may be found. Casts are frequent and are usually hyaline, although fatty and granular casts are not seldom present as well.

Dropsy is not an uncommon symptom, especially in anæmic and emaciated patients. It is usually only moderate in degree and affects only the lower limbs. Diarrhœa is frequent and enlargement of the liver and spleen may be observed, due to the accompanying amyloid degeneration of these organs. Cardiac and arterial changes occur in those instances where the amyloid condition is associated with one of the varieties of chronic nephritis; under such circumstances they are the rule and with them are the other symptoms of chronic nephritis.

The diagnosis is made upon the concurrence of the urinary changes with the primary and causative disease. The presence of hepatic and splenic enlargement are important aids. We should suspect the amyloid kidney in all instances of chronic suppurative or wasting disease associated with increased urine of low specific gravity and which contains albumin and hyaline casts. From the two forms of chronic nephritis amyloid degeneration may be separated by the absence of cardiac and arterial manifestations, the lack of uræmic and ophthalmic symptoms, and by the condition of the urine.

The prognosis, while it depends in great measure upon the causative affec-

tion, is usually unfavorable; it should be unnecessary to state that the amyloid changes are permanent.

Treatment. Prevention consists in the early and proper treatment of syphilis, suppurative bone disease and of the other conditions in which amyloid degeneration of the kidney is likely to make its appearance. In all such, frequent urinary examinations should be made and upon the appearance of albuminuria the question of radical removal of the cause should be considered; this, of course, is possible in a limited number of cases such as in osteomyelitis of a limb, tuberculosis of the knee-joint and the like.

The treatment of the amyloid condition of the kidney occurring as a complicating disease is that of the condition to which it is secondary. Antisyphilitic and antituberculous treatment should be persistently continued so long as symptoms indicating the necessity for their continuance exist. The general condition of the patient should be maintained in the best state possible by means of the employment of nourishing food, particularly milk and cream, of codliver oil, iron, strychnine and quinine and other tonics, and by insistence upon a life in the open air, with proper exercise, and if necessary, change of climate.

Amyloid disease of the kidney after the disappearance of the primary disease should be treated by the measures, dietetic, hygienic and medicinal, advised under the section devoted to the treatment of the chronic nephritides (q.v.).

SUPPURATIVE NEPHRITIS, PYELONEPHROSIS AND PYELITIS.

Synonyms. Surgical Kidney; Suppurative Interstitial Nephritis; Septic or Pyæmic Nephritis.

These conditions being almost invariably very closely associated and almost wholly surgical in treatment, may be considered together

Suppurative nephritis is a pyogenic inflammation of the kidney resulting from infection with the bacteria of suppuration which have reached the organ through the blood current or more usually by an ascending inflammation of the urinary tract. In the latter instance there is first an inflammation of the pelvis of the kidney—a *pyelitis*—which later spreads to the organ itself, becoming a *pyelonephritis.*

Ætiology. As a predisposing cause residual urine in the bladder is most important; this undergoes decomposition and thus becomes a favorable medium for the multiplication of bacteria, infection from which ascends the ureter, involves the pelvis of the kidney and finally the kidney itself. Kidney stone may so irritate the organ as to render its resistance less to bacterial infection and as a consequence a suppurative process may occur. Infective ureteritis, cystitis or urethritis from any cause may spread backward to the pelvis of the kidney and ultimately involve the organ. A very common cause of cystitis and sub-

sequent infection of the kidney is the introduction of dirty sounds or other instruments into the bladder.

Embolic infection through circulatory channels may take place in malignant endocarditis or pyæmic conditions of any kind, and traumatism, operative or otherwise, may so interfere with the resistance of the organ that it becomes an easy prey to infection. Exposure and the infectious diseases act as causes in the same way. Suppurative kidney disease also occurs secondary to malignant and other tumors of the organ.

The infective organisms which have been found in the pus from the kidneys or in the urine and have been considered as causes of the process, are the tubercle bacillus, the bacillus proteus, the colon bacillus, the streptococcus and the staphylococcus.

Pathology. In pyelitis due to ascending infection, the mucous membrane lining the kidney pelvis, is swollen and congested; a grayish false membrane may be present. Dilatation of the pelvis and of the calices, and flattening of the papillæ may take place. The pelvis often contains purulent urine. As a result of the infective process in the pelvis of the organ, extension into the kidney itself may follow (pyelonephritis); the distention finally may result in atrophy of the substance of the organ until the entire kidney becomes a mere sac of pus surrounded by a shell of renal tissue (pyonephrosis); in certain instances if there is an obstruction to the flow of pus from the organ, the former may become cheesy and at times may undergo calcareous degeneration.

Ascending tuberculous inflammation first involves the apices of the pyramids; at first the process is limited but ultimately the kidney undergoes the changes described above, caseous and calcareous degeneration of the purulent contents of the organ being common.

Metastatic infection of the kidney is evidenced by the occurrence within the organ of single or multiple pus foci of varying size. These are disseminated through the cortex and may coalesce to produce larger abscess cavities which destroy the structure of the organ and may ultimately unite to convert the kidney into a sac of purulent matter.

Symptoms. These, aside from the urinary appearances, are often vague. Pain and tenderness in the lumbar region or deep in the abdomen are often present but may not appear even when the kidney is markedly diseased. Impacted calculi cause pain, which is usually intermittent in type, at the site of the obstruction. Chills, fever and sweating are often observed as a result of the septic condition. The chills are often regularly intermittent and resemble malarial paroxysms. In the tuberculous infections the temperature frequently, as the disease progresses, becomes of hectic character. The pulse rate is increased.

Prolongation of the inflammation results in progressive weakness and

emaciation. Metastatic abscesses and general pyæmia may result. Tuberculous pyelitis sometimes runs a course resembling that of enteric fever.

Dyspnœa with cerebral symptoms may occur and even death in coma has been observed and has been considered to be the result of absorption of toxic substances from the urine (ammoniæmia).

The urine contains pus in variable amount; this substance may be wholly absent, if but one kidney is diseased, due to a temporary ureteral obstruction. There may be sudden great augmentation in the quantity of the pus due to rupture of an abscess and the discharge of its contents. The pus may contain fragments of kidney tissue if the inflammation is progressing rapidly. The quantity of the urine at the beginning may be diminished but in chronic cases it is often increased. The specific gravity is low rather than high and the reaction is not constant; it depends upon the micro-organism causing the disease and upon the presence or absence of cystitis which is usually accompanied by an alkaline urine. With the pus, red blood cells are also present, though usually in small number. Albumin is present varying with the amount of pus and red blood cells, although its quantity may be greater than can be accounted for by these elements if there is co-existent parenchymatous nephritis. In the presence of this complication pus casts and those of other varieties are observed. The urine contains a certain amount of mucous and usually numerous epithelial cells. The presence of kite-shaped epithelial cells in considerable number is very suggestive of involvement of the renal pelvis, although a few of these are often observed when cystitis is the only lesion.

Physical examination often reveals tenderness in the lumbar region of the affected side and palpation and percussion may give evidence of a more or less distinct tumor of varying size.

The diagnosis is simple when hæmaturia and pyuria result from injury of the region of the kidney and should always be suspected when with cystitis there is persistence of pus in the urine with tenderness over the kidney. Cystoscopic examination may aid in the diagnosis and ureteral catheterization will definitely prove whether the pus is coming from the renal pelvis. The specific cause of the inflammation can be proven only by bacteriological examination. Staining of the sedimented urine from specimens obtained by ureteral catheterization may reveal the presence of the tubercle or other bacilli and if this fails, inoculation experiments should be undertaken.

The prognosis varies with the cause of the disease. Pyæmic cases are usually rapidly fatal while those complicating the infectious diseases usually recover. Tuberculous pyonephrosis may result in recovery but with the kidney converted into a caseous or calcareous mass. The kidney which is converted into a pus sac may rupture into the peritonæum and any intercurrent disease in a patient afflicted with kidney infection is quite likely to ter-

minate unfavorably. In fine it may be said, however, that in unilateral suppurative disease of the kidney, when not associated with other affections and when diagnosticated early in its course, nephrotomy or removal of the organ offers excellent hope of recovery.

Treatment. The importance of early surgical interference cannot be over-estimated and the same may be said of the employment of the scientific methods of diagnosis, by means of ureteral catheterization, which have recently been perfected. Unilateral tuberculosis calls for removal of the organ, and abscess due to other causes, when sufficient renal tissue to functionate remains, for nephrotomy and drainage. The treatment of pelvic inflammations by means of antiseptic lavage through the ureteral catheter has been advocated and co-existent cystitis should also be treated by irrigations.

For the pain we may employ hot compresses, the turpentine stupe, dry cupping or the mustard paste, kept on until the skin is well reddened, then removed to be reapplied when the blush has faded. If severe, this symptom usually necessitates the hypodermatic administration of morphine, $\frac{1}{4}$ to $\frac{1}{3}$ of a grain (0.016 to 0.022) or the employment of suppositories containing 1 to 2 grains (0.065 to 0.13) of opium. Attempts should be made to dilute the urine by drinking freely of the mildly alkaline waters or of plain water. Probably the only drug which we have, which possesses any influence over the suppurative process, is hexamethylenamine. This is a urinary antiseptic of considerable potency, although unfortunately it appears to have but little effect in tuberculosis of the urinary tract. When given in combination with sodium benzoate, gr. v to viiss (0.33 to 0.5) of the former, gr. x to xv (0.66 to 1.0) of the latter, it renders an alkaline and ammoniacal urine acid, lessens the lumbar pain and may influence the amount of pus. Sandal oil, of which 15 to 20 minims (1.0 to 1.33) may be taken three times daily in capsules, may also lessen the pelvic inflammation and may be given alone or in conjunction with sodium benzoate or benzoic acid. The vegetable diuretices, buchu, kava kava, pichi, pareira, etc., may be employed but are seldom effective.

Tonics should be given to combat the tendency toward progressive weakness and emaciation; here codliver oil, iron, quinine and strychnine will be found useful.

The diet should be bland and nourishing; milk either plain or fermented may be drunk in considerable quantity. The clothing should be warm and all exposure should be avoided.

HYDRONEPHROSIS.

Synonym. Nephrydrosis.

Definition. An accumulation of urine in the pelvis and calices of the kidney caused by an obstruction of the ureter and resulting in more or less dilatation.

Ætiology. The condition may be either congenital or acquired and is the result of obstruction of the urethra or ureter. Congenital instances may be due to stricture of the ureter or urethra, the insertion of the ureter into the kidney at an abnormally acute angle, to twists of the ureter or to congenital defects of the abdominal muscles. The tumor caused by the hydronephrosis in the fœtus may be so great as to interfere with parturition.

Acquired hydronephrosis may result from urethral stricture or prostatic enlargement, in which case the affection is bilateral; from ureteral obstruction due to impacted calculi; from ureteral stricture following ulcerous or other inflammation; from kinking of the ureter which may occur in instances of movable kidney; from external pressure upon the ureter by intra-abdominal tumors, uterine and ovarian in particular, or peritonæal bands; from obstruction of the cystic orifice of the ureter due to tumors (malignant or otherwise) and inflammations of the bladder.

Pathology. The condition is usually unilateral, the obstruction to the outflow of urinary secretion resulting in a gradually increasing dilatation of the pelvis and calices which presses upon the renal tissue and finally produces atrophy and distention of the kidney. Infection with consequent pyelitis and pyelonephrosis may take place. In marked instances there is inflammatory thickening of the pelvis of the kidney while the organ itself is wasted to a thin shell, in the wall of which little or no renal tissue remains. This sac contains a thin yellowish fluid, usually clear, but at times turbid due to the presence of small amounts of pus. The specific gravity is low and the reaction is often alkaline. Small amounts of the urinary salts, urea and uric acid are present and perhaps a trace of albumin may be found.

The ureter may be the seat of marked dilatation, depending upon the site of the obstruction, and there is often hypertrophy of the unaffected kidney and of the left ventricle of the heart.

Symptoms. Bilateral congenital hydronephrosis is incompatible with life, but the unilateral type may cause no symptoms whatever until the resulting tumor becomes apparent upon inspection and palpation. Acquired instances of the disease also may exist for considerable periods without being evidenced by symptoms or, if present, these may be obscured by those of the causative disease, uterine or ovarian tumor, etc.

Pain in the lumbar region shooting down to the groin or thigh, a feeling of weight, and a progressive loss of flesh are not infrequent symptoms. With these lack of appetite and various digestive disturbances, such as nausea, eructations and constipation, which may be of obstinate type if the large intestine is pressed upon by the accumulation of fluid, may be associated. Irritation of the colon by pressure, without interference with the passage of fæces, may cause diarrhœa. The patient may detect a fulness in the region

of the kidney and in marked instances the abdomen may be so distended as to suggest ascites.

Physical examination reveals a tumor which upon inspection is evidenced by a fulness of the hypochondrium and in the lumbar region; this tumor is likely to enlarge gradually, the increase in size being detected by measurment of the abdomen at intervals. Upon palpation a rounded, firm and elastic tumor is felt. Fluctuation may be elicited and tenderness may be present. Percussion over the tumor elicits a dull or flat note unless the colon passes between it and the abdominal wall; over the colon the note is tympanitic.

Intermittent hydronephrosis is an interesting condition in which the tumor disappears or varies in size from time to time; this occurrence is due to sudden removal of the cause of the ureteral obstruction. This is likely to take place in hydronephrosis due to kinking of the ureter which is common in movable kidney, and also may be observed when there is a valvular stricture of the ureter or an abnormal insertion of this structure into the kidney. With the diminution in size of the tumor comes a sudden increase in the flow of urine. Previous to this occurrence colicky pains may be observed..

Uræmia may take place if a double hydronephrosis is present.

The diagnosis is difficult if the retained fluid is small in quantity but when the condition is evidenced by a gradually increasing tumor in the flank which diminishes or disappears with greater or less suddenness with an associated augmentation of the urinary secretion, (the flush-tank sign) the affection can hardly be mistaken. Large hydronephroses may be confounded with ovarian cysts or even with ascites, but the demonstration of the colon anterior to the tumor will exclude these latter conditions and aspiration of a small portion of the collected fluid by means of an exploring needle, will reveal the characteristic fluid of a nephrydrosis. Pyonephrosis is characterized by the presence of a febrile movement and pyuria. The diagnosis in doubtful instances may be confirmed by means of ureteral catheterization. While the obstruction is present little or no urine will be drawn through the catheter passed into the ureteral orifice of the affected side.

The prognosis is usually grave although certain instances have been reported in which a disappearance of the tumor due to unblocking of the obstructed ureter has not been followed by re-accumulation. Rupture of the sac rarely takes place. Double hydronephrosis is an especially unfavorable condition owing to the danger of uræmia, and infection of the cyst contents with resulting pyonephrosis is likely to prove fatal unless prompt surgical intervention is instituted.

Treatment. Hydronephroses of intermittent type seldom need radical treatment and the management of the patient should be along dietetic and hygienic lines such as those advised in pyelitis and pyonephrosis. Very careful massage of the tumor in certain instances may bring about a removal

of the obstruction and a partial or complete emptying of the sac. All cases should be studiously watched for the occurrence of infection of the cyst contents. If the nephrydrosis is due to the movability of the kidney the treatment, after the emptying of the sac, is that of this condition (see p. 676).

The treatment is, with the exception of the above points, wholly surgical, and the measures which may be employed should be varied to suit the case in hand. Simple aspiration often becomes necessary when the quantity of fluid becomes large and re-accumulation may necessitate a repetition of the operation. The needle is usually introduced in the flank at a point midway between the twelfth rib and the iliac crest. More radical procedures which may be undertaken upon the advice of the surgeon are incision and drainage of the sac with establishment, if necessary, of a permanent urinary fistula, or complete nephrotomy.

PARANEPHRITIS.

Synonyms. Perinephritis; Perinephritic Abscess.

Definition. A suppurative inflammation of the connective tissues about the kidney.

Ætiology. Primary paranephritis occurs as a result of infection following traumatisms of the region of the kidneys. Secondarily the condition develops as a result of one of the acute infectious diseases, especially in children; of extension of some suppurative process in the kidney itself, its pelvis or the ureter; of intestinal perforation, particularly that due to appendicitis; of spinal suppuration and the caries of Pott's disease; and of extension of an empyæma.

Pathology. There may be several small abscess cavities in the tissues posterior to the kidney, or this organ may be found lying in a single abscess cavity of larger size. The process usually begins behind the kidney, consequently most of the pus is found in this situation, though more rarely it may be found between the organ and the peritonæum. The pus is often of foul odor as a result of its contiguity to the large intestine. If the condition is the result of intestinal perforation the odor is likely to be fæcal. The pus most frequently burrows downward and may reach the surface through the tissues of the groin or it may perforate the intestine, the peritonæal cavity, the vagina or the bladder. More rarely it works its way outward through the lumbar tissues or upward through the diaphragm into the lung whence it is discharged through the bronchi.

A seldom observed condition is a chronic perinephritis which has given no symptoms during life and which is characterized by a firm and fibrous capsule surrounding and adherent to the true capsule of the kidney; this is the result of an inflammatory degeneration of the perirenal fatty tissue.

Symptoms. In instances secondary to other disease the symptoms of the primary affection are present; suppuration of the perirenal tissues is evidenced by pain and tenderness upon pressure in the neighborhood of the kidney. The lumbar tissues may be œdematous. The pain is referred not only to the region of the kidney but also by many patients to the hip or knee, this is due to the pressure of the suppurating mass upon the nerves of the lumbar plexus, terminal branches of which are distributed to the vicinity of these joints. While lying, the patient finds relief from the pain by flexing the thigh of the affected side upon the pelvis and if able to stand, he rests most of his weight upon the leg of the sound side and stoops forward. Adduction of the thigh is difficult and painful. After the formation of pus there are chills, an irregular fever and sweats. If rupture has taken place into the pelvis of the kidney or if the perirenal process has resulted from pyelitis or renal suppuration, there is pyuria. Palpation of the abdomen and lumbar region reveals an indurated area between the twelfth rib and the iliac crest and a definite tumor may be felt in some instances.

The diagnosis is usually not difficult. The history of traumatism or of primary disease is important. Hip and knee-joint disease may be excluded by examination of these parts. The tumor is less distinct in outline than that of renal abscess and in uncomplicated instances the urine is unaffected. Movements of the thigh, especially adduction and flexion, are painful.

The prognosis is most favorable in the traumatic cases and when early diagnosis is made. Rupture in the lumbar region is more favorable than into the groin, peritonæum or elsewhere.

Treatment is entirely surgical and consists in free incision, thorough evacuation of the pus and drainage. Involvement of the kidney itself in the suppurative process may necessitate nephrectomy.

NEPHROLITHIASIS.

Synonyms. Renal Calculus; Kidney Stone; Gravel.

Definition. Nephrolithiasis is the term applied to that condition of the kidney and renal pelvis which is characterized by the formation or presence, in either of these structures, of concretions resulting from the precipitation of any of the solid elements of the urine.

Ætiology. It is difficult to explain the cause of the precipitation which results in the formation of a renal calculus. The condition is more common in men than in women and is chiefly seen in childhood and beyond middle life. Heredity seems to have a certain influence in many instances and as other predisposing causes sedentary life, the purinæmic state and kindred conditions may be mentioned.

Speaking generally it may be stated that the formation of calculi is encour-

aged by the presence in the urine of an excess of normal solid constituents or of abnormal solid ingredients. Many stones which have as their origin collections of bacteria, bits of epithelium or mucus, the eggs of parasites, coagulated blood and casts, around which crystals have been deposited, have been observed, which shows that the presence of foreign substances is a causative factor in many instances. Uric acid calculi, the most frequent variety, are believed to be likely to occur in the presence of a urine of increased acidity containing a large amount of uric acid, but a small quantity of salines and possessing a light color.

Pathology. Renal concretions may be classified according to their size and their chemical constitution. The former classification is as follows: *a. Renal sand* which consists of fine gritty particles which usually are single uric acid crystals or a number of these adherent to one another. *b. Renal gravel* which is made up of coarser grains which may even be larger than a good-sized pea. *c. Renal stone* which may attain the size of a hen's egg. These often form casts of the pelvis of the kidney or its calices and may be branched (dendritic or coral calculi). Chemically kidney stones are composed of: *a. Uric acid* and its sodium, ammonium or potassium salts. These are of any size from the largest to the smallest, and are hard, brownish or black in color and of irregularly smooth surface. *b. Calcium oxalate* (mulberry calculi). These stones are hard, of uneven and rough surface, may be of any size and are often formed about a nucleus of uric acid. *c. Phosphatic* calculi are less common than either of the preceding varieties. They often reach a very large size, are grayish or white in color and may be so soft as to permit of crushing between the fingers. They are more frequently observed in the bladder and are composed of calcium and ammonium-magnesium phosphate often deposited about a nucleus of uric acid or calcium oxalate. *d.* Rarer varieties of renal calculus are composed of cystine, xanthine, urostealith, calcium carbonate, fibrin and indigo

The changes in the kidney due to the presence of calculi vary with the irritation which they cause, their size, their number and with their passage or retention. Numerous stones may exist in the calices without causing any abnormal condition of the lining of the pelvis; on the other hand their presence may cause turbidity of the urine and desquamation of the pelvic epithelium. Gravel may be passed at intervals without causing symptoms or pelvic lesions and larger stones may cause successive attacks of renal colic in their passage while no changes take place in the kidney or its pelvis. Dendritic calculi may exist in the pelvis for years without causing inflammation but their continued presence ultimately results in induration of the kidney. Serious consequences of kidney stone are pyelitis and pyonephrosis, and hydronephrosis may be caused by the impaction of a calculus in the ureter.

Symptoms. The most constant symptom of calculus in the kidney is pain

in the region of the kidney; with this is associated, in greater or less degree, tenderness. The pain is usually referred to the affected kidney but sometimes to the normal side; it may radiate in the direction of the course of the ureter and even as far as the penis or scrotum; it is increased upon motion. Hæmaturia is sometimes present. The blood is seldom of large amount and may be absent from time to time; it is increased by exercise or violent motion of any kind. A small number of pus cells is frequently present in the urine even if true pyelitis does not exist; mucus and the brick dust crystals of uric acid are often found; calcium oxalate crystals are also common. The reaction of the urine is alkaline in the presence of phosphatic calculi, acid with those of uric acid, while with calcium oxalate stone the reaction may be acid, alkaline or neutral. Complete occlusion of the ureter by a calculus results in hydronephrosis with its attendant symptoms (q. v.).

Renal colic is caused by the entrance of a stone into the ureter and its attempt to force a passage. Its onset may be sudden without assignable cause or it may follow muscular exertion. It is evidenced by most extreme pain beginning in the region of the kidney and radiating along the course of the ureter to the groin, inside of the thigh, or testicle, which last may be retracted. More rarely the pain extends through to the back or upward to the diaphragm. A chill followed by a considerable rise in temperature may usher in the attack. Nausea and vomiting are frequent symptoms and localized tenderness may be present; cold, clammy sweat may break out upon the skin and a condition of collapse may ensue. The attack may last from an hour or two to a day or more and ceases when the calculus has reached the bladder. In the prolonged paroxysms periods of intermission are common. There is frequent passage of urine which usually contains blood. Each urination as a rule is small in quantity but at times clear urine may be voided in considerable amount from the normal kidney. Suppression of urine with consequent uræmia may occur. After the attack there is more or less localized pain over the region of the kidney and ureter, and the testis of the affected side may be swollen and tender. Intermittent discomfort in the lumbar region may remind the patient for months afterward of his paroxysm. The stone may remain in the bladder or be passed through the urethra. Successive attacks often are observed but certain patients after having suffered from one never experience another.

The diagnosis. The condition may be confounded with intestinal or hepatic colic; in most instances, however, renal colic possesses certain characteristics, such as pain radiating down the ureter to the testis, retraction of this organ and the characteristic urine, which render the exclusion of the two former conditions easy. Intestinal colic is likely to follow errors of diet, the pain is most often in the umbilical region and there are associated flatulence and constipation. In hepatic colic there is likely to be jaundice, with

clay-colored stools and pigmented urine and the pain is usually referred to the region of the gall-bladder. Vesical calculus when causing pain which cannot be differentiated from that of ureteral calculus, may be diagnosticated either by means of the "searcher" or the cystoscope; in bladder stone the reaction of the urine is usually alkaline, while in calculus higher in the urinary tract is commonly acid. Calcium oxalate calculi, being more rough of surface, are said to cause a more severe type of paroxysm than those of uric acid, while the pain of phosphatic stone is considered to be even more marked.

A most important aid, and one never to be neglected in doubtful instances or before the institution of surgical measures, is examination by means of the Röntgen ray. Properly taken plates, will, with hardly an exception, prove the presence or absence of a stone and are also useful in locating its position. Fluoroscopic examination is unsatisfactory and it should be remembered that the skilled eye can often demonstrate a calculus upon a plate which to the untutored appears wholly negative.

The prognosis. While a single attack of renal colic may be all to which the patient is subjected, more frequently others will ensue and the continued irritation of the kidney and its pelvis is likely to result in a suppurative condition. Large calculi remain permanently in the pelvis of the kidney unless removed by operation. Fatal attacks of renal colic have been reported. Under the present day surgical treatment of kidney stone the prognosis has become far more favorable than previously.

Treatment. As a prophylactic measure all persons possessing the so-called uric acid or purinæmic tendency should be subjected to the dietetic and other measures suggested under the treatment of purinæmia (see p. 263); that is to say the nitrogenous elements of the diet should be to a considerable degree restricted and for them carbohydrates should be substituted. The urine should be kept abundant in amount and its acidity should be diminished by the free drinking of any *pure* water. The much exploited alkaline and lithia waters are probably in no way superior to ordinary pure distilled water but it is often wise to prescribe them since the patient will take a prescribed daily amount of a named and supposedly medicinal water when he will wholly neglect his physician's advice if the agent prescribed is nothing more than the fluid which flows from the tap of his kitchen sink. Any of the various "lithia" waters is to be recommended since these are usually pure. Likewise the patient who will not drink a sufficient quantity of plain water will often take it contentedly if advised to add to each glass 10 grains (0.66) of lithium carbonate or citrate. The quantity of water advisable for these cases is from 1 to 2 quarts (1 to 2 litres) daily. The diuretic and antacid effect of the water may be augmented by taking in addition 15 to 20 minims (1.0 to 1.33) of liquor potassæ well diluted, potassium citrate, 20 grains (1.33), or potassium

bicarbonate, 20 to 30 grains (1.33 to 2.0), three times a day. The possibility of rendering the urine so alkaline as to predispose to the formation of phosphatic calculi must not be forgotten, for calculi composed of phosphates about a nucleus of uric acid have been observed. Consequently the urine should be frequently examined and the appearance of an excessive alkalinity should be considered a signal for a diminution or an intermission of the measures which have brought about this state.

The employment of calcium carbonate in doses of from x to xx grains (0.66 to 1.33) three times a day has recently been advocated upon the hypothesis that the combination of the calcium with the acid phosphates in the alimentary tract diminishes the deutero-phosphates of the urine with the result that the proto-phosphates remain to dissolve the uric acid.

Calcium oxalate calculi should be treated both dietetically and medicinally along the same lines as those advised for uric acid stone but in phosphatic calculi a different mode of treatment is necessary. Here the problem is to render the urine acid and the best means of accomplishing this object is by the employment of a diet directly the opposite of that indicated in hyperacid conditions. The food should be chiefly of meat and the carbohydrate elements should be restricted. The urine should be kept diluted and increased in quantity by the free use of a water *not* alkaline. The most serviceable drugs in rendering the urine acid are benzoic acid and its sodium and ammonium salts; the latter are preferable because of their greater solubility. The dose of either is from 10 to 15 grains (0.66 to 1.0). Boric acid also will render an alkaline urine acid and is most effective when employed as potassium tartraborate; its dose is 20 grains (1.33) three or four times daily diluted in a large amount of water. Its taste may be disguised with licorice or syrup of orange peel.

The so-called uric acid solvents, piperazin, lysidin, lycetol, etc., may be given in the hope of dissolving already formed calculi but, while these drugs may succeed in dissolving uric acid in the test-tube, it is doubtful if they possess any distinctly solvent action over uric acid in the kidney or its pelvis. Piperazin may be given in doses of $7\frac{1}{2}$ to 15 grains (0.5 to 1.0) three times a day in water, plain or carbonated; its marked hygroscopic properties prevent its administration in pill or powder. Lysidin may be taken in doses of $\frac{1}{2}$ to $2\frac{1}{2}$ drachms (2.0 to 10.0) of the 50 percent. alkaline solution in a glassful of carbonated water. The dose of lycetol (dimethyl-piperazin tartrate) is from 5 to 10 grains (0.33 to 0.66) three times a day in carbonated water or lemonade.

Hexamethylenamine is considered to have a certain amount of lithontriptic effect. It certainly is the most effective urinary antiseptic which we possess; it is particularly indicated in patients with phosphatic calculi and alkaline urine but is beneficial as well in the other varieties of stone. Given in combination with sodium benzoate—hexamethylenamine gr. viiss (0.5), sodium benzoate gr. x (0.66)—it will tend to render the urinary tract antiseptic, and

may relieve the pain in the region of the kidney, which is a frequent accompaniment of renal stone.

The pain of an attack of *renal colic* can usually be controlled by nothing less potent than a considerable dose of morphine—at least ¼ grain (0.016) given hypodermatically and repeated if necessary. Suppositories containing each 1 grain to 1½ grains (0.065 to 0.1) of powdered opium and ¼ to ½ grain (0.016 to 0.032) of extract of belladonna are also useful. For the very severe paroxysms it may be necessary to give chloroform by inhalation until the effect of the morphine has taken place. In certain instances the coal tar analgesics, antipyrine salicylate (salipyrine) or acetphenetidine (phenacetine) in 10 grain (0.66) doses will relieve the pain to some extent and almost always the employment of hot compresses or poultices of flax-seed are of benefit; these and hot bathing may relax the ureteral spasm and render the passage of the stone more easy. Hot drinks, such as lemonade, arrowroot gruel, etc., are frequently grateful to the patient and changes in position, such as lowering the head and raising the buttocks, at times afford a certain amount of relief.

When the calculus has reached the bladder the agonizing pain disappears. The stone now is usually passed through the urethra or it may remain in the bladder to increase in size as a vesical calculus.

In nephrolithiasis, operation and extraction of the stone is necessary if the latter is too large to enter the ureter, becomes impacted during its passage, or if any suppurative process is present.

NEOPLASMS OF THE KIDNEY.

The kidney may be the seat of tumorous growth of either benign or malignant type. Of the former the *fibroma* is the most common; this neoplasm is usually small and even when multiple may not appreciably increase the size of the organ. Other benign tumors which may involve the kidney are the *lipoma*, the *angioma*, the *adenoma* and the *villous papilloma* which may have its origin in the pelvis of the organ. Cystic tumors are frequent and will be discussed in a separate section. Gumma of the kidney may also occur.

Malignant neoplasms of the kidney are of two varieties—*carcinoma* and *sarcoma*. The latter is the more frequent and is met in one of two forms, the alveolar sarcoma and the rhabdomyoma; renal sarcoma is often observed in children. Malignant tumor of the suprarenal body—*hypernephroma*—often involves the kidney itself as well, and it is probable that in many instances apparently primary malignant tumors of the kidney are in reality primary in the suprarenal capsule and secondary in the former organ.

The malignant new growths may become so large as to nearly fill the abdominal cavity, they usually increase in size rapidly and are often the seat of hæmorrhage.

Symptoms. The smaller benign tumors often give no symptoms; one of the most typical symptoms of malignant disease of the kidney is hæmaturia, it is, however, by no means constant. The blood may be either fluid or clotted and it may appear in the form of casts of the renal pelvis or ureter. Blood is more common in the urine of carcinoma than in that of sarcoma; rarely the urine may contain fragments of the growths from which the diagnosis may be made.

Pain is present in certain instances but by no means in all. In character it may be a dull ache in the region of the kidney or it may be referred to the hip, thigh or knee because of the pressure of the growth on branches of the lumbar plexus. Pressure upon and erosion of the vertebræ cause severe pain and the passage of clots of blood through the ureter is often attended with symptoms suggestive of renal colic, the pain, however, is rather less marked. Progressive emaciation with ultimate cancerous cachexia is frequent although in some instances the patient's nutrition may remain in good condition.

Physical Signs. Bimanual palpation usually detects the presence in the region of the kidney of a tumor which is not movable from side to side but moves in a vertical direction with respiration, though less so than do growths involving the liver. In consistence the tumor may be firm or, if of rapid growth, soft. In children the enlargement of the abdomen is often marked and the superficial veins are dilated. The hand may be able to insert itself between the tumor and the liver on the right side and between it and the spleen on the left; early in the disease tympany may be elicited upon percussion of this space but later this is likely to become impossible. Renal neoplasms enlarge anteriorly rather than backward and push forward the colon, the presence of which between the growth and the abdominal wall, as evidenced by obtaining a tympanitic note upon percussion, is an important point in the differentiation of tumors of the kidney from those of neighboring organs.

The differential diagnosis of sarcoma from carcinoma may be based upon the following points: the former is more common and is most frequently seen in young children while carcinoma is usually observed in later life. In the latter the emaciation is more rapid, hæmaturia is more common and metastatic growths are often observed.

Tumors of the kidney may be differentiated from ovarian tumors by the more frequent occurrence of urinary changes and by the fact that the colon is usually demonstrable between the growth and the abdominal wall, while in the latter condition there is tympany in the flanks, the intestines being in this region, the tumor grows upward from below, there are often symptoms referable to the genital tract and rectal and vaginal examination reveals genital abnormalities.

The tumor of retroperitonæal glandular enlargement is not associated

with urinary symptoms and the growth is central instead of being rather upon one side. A confusing sign may be the presence of tympany upon percussion due to the position of the intestines in front of the tumor.

Hepatic tumors move more freely during respiration than do those of the kidney; there is often prominence of the right hypochondriac region and the edge of the liver is often palpable.

Enlargements of the spleen move freely with the descent of the diaphragm and the tumor extends downward from above; its edge is palpable and the marginal notch may be demonstrated. The growth is in contact, as a rule, with the abdominal parietes and consequently percussion yields a dull note.

The prognosis is unfavorable even if the tumor is removed while still small and before the incidence of metastases. Sarcoma is usually fatal within a few months while in carcinoma life may be prolonged for a more extended period.

Treatment, aside from radical surgical measures, consists merely in rendering the patient as comfortable as possible by the employment of hypnotics when necessary and in the administration of tonics and a nutritious diet in order that bodily strength may be maintained as long as possible.

THE CYSTIC KIDNEY.

Cysts of the kidney may be either congenital or acquired; in the congenitally cystic kidney the condition is usually bilateral, the affected organ containing a number of rounded cysts ranging in size from that of a small pea to that of a hen's egg. The enclosed fluid may be clear or turbid, brownish-red or dark brown in color, acid in reaction, and it contains albumin, urinary salts, blood and more rarely uric acid and urea. Usually this affection results in early death, but in infrequent instances adult life may be reached and the condition has been found at autopsy, having given no symptoms *intra vitam.* Large fœtal cystic kidneys may cause obstruction to labor.

Acquired cysts of the kidney are of various types:

a. Retention cysts. These are usually small and contain fluid which has once been urine but has become watery; it may contain albumin and traces of the urinary solids. This condition is observed in chronic nephritis as a result of stenosis of the tubules by the increased connective tissue. Large cysts have been observed in kidneys which present no other abnormality. These may contain blood and probably are also to be classed in this group.

b. Dermoid cysts of the kidney have been reported. These may occur in otherwise healthy kidneys.

c. Hydronephrotic cysts. Hydronephrosis in which pressure has reduced the kidney to a mere shell (see p. 708) may be classed among the cystic conditions affecting this organ.

d. Renal cysts occurring with a cystic condition of other organs, partic-

ularly the liver, spleen and thyroid gland. This form of cystic disease is, in all likelihood, the result of defective development.

e. Hydatid cyst of the kidney is seldom observed. The diagnosis is made upon the demonstration of hooklets or bits of the cyst wall in the urine and upon associated hydatid disease of other organs. Hydronephrosis may result from ureteral obstruction due to the attempt to pass these fragments.

Symptoms. These consist of the presence of a tumor in the renal region, the physical signs and differential diagnosis of which have been discussed in the section upon renal neoplasms (p. 717); of hæmaturia which is usually intermittent and, in instances of cysts due to obstruction of the tubules by the interstitial growth of a chronic nephritis, the symptoms of this primary condition, such as heightened arterial tension, arteriosclerosis, cardiac hypertrophy, a urine increased in amount, of low specific gravity and urea content, and containing albumin and casts, are present.

The physical signs are those of tumors of the kidney (p. 717) and of hydronephrosis (see p. 709).

The diagnosis is based upon the same general points as that of tumor.

The prognosis in double cystic kidney is unfavorable, operation being out of the question, and the probability of uræmia or heart failure, especially when the cysts occur in chronic nephritis, being great. Unilateral cystic disease is amenable to cure by operation and the possibility of rupture of a cyst and consequent perinephritis or peritonitis is not to be forgotten.

Treatment, aside from the relief of pain, maintenance of the patient's nutrition and the management of the chronic nephritis, if this is present, is wholly within the province of the surgeon. The operation should be adapted to the condition in hand, it being possible to enucleate single cysts without removal of the kidney. Nephrectomy may be performed when this is impossible.

IDIOPATHIC HÆMATURIA.

Synonyms. Renal Epistaxis; Unilateral Renal Hæmorrhage.

Definition. Blood appearing in the urine from unknown cause. The condition is not a very frequent one and is to be distinguished from the hæmaturia of the kidney lesions previously described, from malarial hæmaturia and from renal hæmorrhage occurring in anæmia, leukæmia and other diseases of the blood, from that of traumatism and that of parasitic disease.

Symptoms. Of these the most characteristic is the appearance of blood in the urine. The blood is seldom passed in clots but is usually mixed with the urine, which is acid and of smoky tinge when passed, becoming brighter red as alkaline fermentation takes place. Albumin is present in quantity varying with the amount of blood, and red blood cells, leucocytes and blood casts are demonstrable by the use of the microscope.

In typical instances no other symptoms are present, although there may be complaint of lumbar pain. With the persistence of the hæmorrhage, progressive weakness ensues. The condition may be associated with renal displacement, pelvic lesions and destructive changes in the kidney.

Treatment consists chiefly in the insistence upon rest in bed and the application of cold to the lumbar region, together with the administration of agents which increase the coagulability of the blood and of astringents. Of the former the most effective is calcium lactate which may be given in doses of 20 to 30 grains (1.33 to 2.0) three times a day. Rather less efficient is calcium chloride 20 grains (1.33) three times daily. Gelatin also has a certain action in the increase of the blood's coagulability and it may be given both hypodermatically and by mouth. For purposes of subcutaneous administration 2½ percent. of purified gelatin is dissolved in normal saline solution; of this an ounce (30.0) or more may be injected at a time. The gelatin when given internally may be prescribed in the following formula: Pure gelatin 5 to 10 parts, distilled water 150 parts, simple syrup 25 parts; of this a dessert spoonful (8.0) is to be given every two hours. It may be taken, if necessary, in larger quantity and prescribed in 10 percent. solution of which a pint (500.0) may be taken daily. Ergot in the form of ergotine injected under the skin in doses of 5 to 10 grains (0.33 to 0.66) or given by mouth in similar dose may be employed. Astringents, such as lead acetate, alum, gallic and tannic acids, catechu, hamamelis virginica, and iron persulphate may be tried but little is to be expected of them. Electric baths may benefit the patient.

The diet should be chiefly of milk. Demulcent and acidulated drinks may be permitted.

HÆMOGLOBINURIA.

Definition. A condition in which blood-pigment appears in the urine The coloring matter may be either hæmoglobin or methæmoglobin and may be associated with the presence of a few red blood cells either intact or in a state of disintegration. Hæmoglobinuric urine is reddish-brown or black in color if the pigment is present in considerable amount; if only in small quantity the urine is smoky. Upon standing a heavy brown sediment is deposited. Albumin is present and the use of the microscope reveals the presence of blood cells, epithelial cells, urates and pigment granules. Spectroscopic examination detects the bands of absorption which characterize the spectrum of oxyhæmoglobin or that of methæmoglobin. In the former instance, which is more infrequent than the latter, the bands are two in number. The spectrum of methæmoglobin exhibits three bands, that in the red near *C* being typical.

Hæmoglobinuria, clinically, may be divided into two separate varieties.

TOXIC HÆMOGLOBINURIA.

This type of hæmoglobinuria is caused by the presence in the organism of poisonous substances which separate the hæmoglobin from the red cells. Such poisons are phenol, pyrogallic acid, sulphuretted and arsenuretted hydrogen, carbon monoxide, naphthol, nitrobenzol, potassium chlorate and the toxic substances contained in mushrooms. It also occurs as a result of the presence of the toxins of the infectious diseases such as enteric fever, scarlatina, yellow fever, syphilis and especially malaria (blackwater fever), and has been observed after excessive muscular exertion, exposure, severe burns and during pregnancy. The transfusion of blood from one mammal to another results in hæmoglobinuria and finally, a form of this condition may be met in newly-born infants where it is accompanied by cerebral symptoms, venous congestion and jaundice.

The prognosis is usually favorable but is dependent upon the cause and the severity of the accompanying symptoms.

PAROXYSMAL HÆMOGLOBINURIA.

This is a rare condition occurring usually in adults and more frequently in men than in women. The attacks appear at intervals, are of sudden onset and are characterized by the passage of urine containing blood pigment. Chilly feelings, fever, and general pains may be associated with the paroxysm which rarely lasts more than a day. Several attacks in the course of a day have been observed. Nausea and vomiting and lumbar pain may characterize the seizure and at times the temperature is subnormal. As causes, exposure to cold and wet, excesssive muscular exertion and malaria may be mentioned. Individuals suffering from Raynaud's disease may be subject to hæmoglobinuric attacks but the association of the two conditions has not been satisfactorily explained.

An associated symptom is jaundice and the condition is always preceded by the appearance of free hæmoglobin in the blood (hæmoglobinæmia).

No satisfactory explanation of the pathogenesis of hæmoglobinuria has yet been advanced; the best manner in which we can at present account for the condition is to say that in some fashion an increased hæmolysis is brought about and the resulting hæmoglobin is dissolved in the fluid elements of the blood and later appears in the urine.

The prognosis is favorable as a rule but the paroxysms may persist for considerable periods.

Treatment. Prevention, in both forms of hæmoglobinuria consists in the avoidance of exposure and of over-exertion. Upon removal to a warm climate the frequency of the attacks becomes much reduced. In the treatment of the condition itself we should endeavor to eliminate the causal factor by stopping the ingestion and aiding the elimination of poisons and by proper

treatment of any infectious condition which may be present. If the hæmoglobinuria is the result of syphilis, mercury and the iodides should be prescribed; if it is due to malarial poisoning, quinine should be ordered. The latter drug should be given with caution since it is said to increase the tendency to hæmoglobinuria in some instances. The attack itself may sometimes be aborted or shortened by means of inhalations of amyl nitrite. During the seizure the patient should be kept in bed and warmly covered; he should be protected from draughts and may be given hot drinks. The employment of astringents and of other means suited to the treatment of renal hæmorrhage has been suggested.

The anæmia secondary to the destruction of the red blood cells necessitates the administration of tonics, iron in particular.

CHYLURIA.

Definition. A rare condition in which the urine is mixed with minute droplets of fat imparting to this secretion a milky appearance. The chyle varies in amount from a quantity so small as to render the urine only slightly opalescent to so large an admixture that this fluid becomes opaque, white and scarcely to be distinguished by its appearance from milk. With the chyle, blood is often present and the latter, upon allowing the urine to stand, may form a clot at the bottom of the vessel while the former rises to the surface, forming a creamy layer. Microscopical examination reveals the presence of red blood cells in varying number and of granular fatty matter; more seldom the fat may be visible in droplets as in milk.

Ætiology. The most usual cause of chyluria is the parasitic disease due to the *filaria sanguinis hominis* or filaria Bancrofti (see the section upon parasitic diseases) but even in this affection chyle is not always present in the urine. Other instances of chyluria are difficult of explanation but must occur as a result of a communication between the chyle vessels and the urinary tract, although this condition has not been reported as a *post mortem* finding. Certain it is, however, that chyluria may exist when careful blood examination during life and thorough search after death reveal the presence of no embryo filariæ or eggs.

Symptoms other than the condition of the urine, which contains chyle constantly or intermittently, are usually wanting. In certain instances there is loss of flesh and strength, lumbar pain or occasional discomfort in urination resulting from obstruction to the passage of coagulated material through the urethra.

The prognosis as to life is favorable but the passage of chyle in the urine may persist continuously or intermittently for years. In some instances it may cease spontaneously.

Treatment consists merely in making the patient as comfortable as possible and in the employment of measures calculated to maintain nutrition.

INDICANURIA.

Definition. A condition characterized by the presence of indican (indoxyl-potassium-sulphate) in the urine. The presence of this substance may be proven by the employment of Obermeyer's test or others of like character. Of these perhaps the simplest is the following: To a few drops of 5 percent. aqueous solution of ferric chloride in a test tube add about 5 c.c. each of hydrochloric acid and urine; shake and allow to stand for about ten minutes; add about 2 c.c. of chloroform, shake again and allow the chloroform to settle to the bottom of the tube. If indican is present the chloroform will take a more or less intense blue tinge. (For more elaborate tests the reader is referred to works upon laboratory diagnosis.)

Ætiology. In the majority of instances the presence of indicanuria signifies the absorption of indol from the alimentary tract. When it is not due to this cause the existence of an abscess somewhere in the body or that of a dead fœtus may account for its appearance. Indicanuria being merely a symptom of the presence of indol in the intestine, it behooves us to consider this substance for a moment. Indol is a product of the putrefactive decomposition of proteid bodies and it is formed in the colon during the course of putrefactive processes occurring within this viscus; from this situation indol is absorbed and is excreted by means of the urine in the form of indican.

In the human intestine indol is formed by the action of living micro-organisms upon proteid material, possibly with the aid of the processes of digestion, and is probably responsible for various toxic conditions. It is probable that the presence of free indol in the blood may depress the muscular system as is shown by the fatigue which appears rapidly in some individuals who have been affected with marked indicanuria for a considerable period. Experiments have shown that a small quantity of indol acting for some time upon a muscle lessens its working power. This fact has led to the supposition that certain instances of myasthenia gravis in which indicanuria is present may be caused by the presence of indol or some kindred substance in the circulation.

Normally there is little or no indican in the urine of children but in adults this body may be present in moderate amount for considerable lengths of time without being evidenced by any associated disturbance of health. Even large quantities of indican may occur in the urine at intervals but in individuals who exhibit this phenomenon there is usually some concomitant disorder of the digestive system or toxic condition of other type. These facts may appear puzzling but when we consider that certain organisms are able to defend themselves against the poisonous effects of indol, while others are less fortunate, the matter is explained, at least to some extent. The cells in youth possess far more power to oxidize indol than in age, and in consequence it is likely that the body is more apt to suffer from the absorption of a given amount

of indol in childhood or young adult life than in middle or old age, even putting out of the question the presence of the degenerations of the organs which often exist under the latter conditions. Thus in estimating the importance of the presence of indican in the urine of a given patient, we must consider his age and whether the organs are in a state of degeneration.

In certain subjects constipation has a marked influence upon the production of indicanura, but children and, less frequently, adults may often go for some days without defæcating and exhibit no indican in the urine; this fact is difficult of explanation but it is probable that when there is stagnation of food residue in the colon the presence in this viscus of undigested proteid is necessary to the production of indol, and if the stoppage of the food remnants is in the small intestine indol is not produced unless colon bacilli or other bacteria which are able to make indol from peptone or albumose, are present.

Treatment. In view of the causation of the condition under consideration it is natural to hold as the first indication a thorough cleansing of the intestine by means of catharsis. Perhaps as simple and effectual a method as any of relieving the burdened digestive tract of its contents is the administration of repeated fractional doses of calomel, to be followed after some hours by one of the saline purgative waters. The continued use of cathartics is however unadvisable. (See the treatment of chronic constipation.) In securing intestinal antisepsis, which we should endeavor to do after thorough purgation has taken place, the most effective agents at our command are bismuth tetraiodophthaleinate and bismuth naphtholate; of these from 5 to 8 grains (0.33 to 0.5) may be given three times daily. Resorcinol also may be employed.

Diet regulation is most important, and in many patients the indicanuria may be reduced by lessening the quantity of meat in the regimen; milk may be substituted for the meat in many instances to advantage. When, in spite of the employment of a milk diet, the indicanuria is persistent, especially if the patient is syphilitic or is a subject of arterial degeneration, the administration of potassium iodide may bring about the desired effect and the administration of iron, particularly liquor ferri et ammonii acetatis, has accomplished good results where other means have failed. In considering the diet it must be remembered that the carbohydrates, if consumed in excess, should be diminished as well as the proteids. When, despite regulation of both the carbohydrate and the proteid intake, the urine continues to contain indican, jellies made of gelatin (indol is not formed from this substance) may be prescribed to take the place of a portion of the necessary proteid food.

CHAPTER X.

DISEASES OF THE NERVOUS SYSTEM.

DISEASES INVOLVING CHIEFLY THE BRAIN AND ITS MEMBRANES.

ACUTE ENCEPHALITIS.

Synonym. Acute Cerebritis.

Definition. A primary acute inflammation of the cerebral tissue.

Ætiology. This condition is the result of microbic infection. It is predisposed to by any cause which lowers the body resistance, such as acute alcoholism. As a primary disease it seldom if ever occurs but it is seen in most instances as a complication or sequela of the acute infectious diseases, such as scarlet fever, variola, measles, influenza, infectious endocarditis or other septic conditions.

Pathology. The portions of the brain most often involved are the base, the temporal lobes and the corpus striatum. There is intense inflammation and congestion with serous exudation, migration of leucocytes and minute hæmorrhages; the neighboring cerebral substance may become softened. In mild cases the inflammatory process may subside with absorption of the exudate and small sclerosed areas may result, permanently impairing the brain function. In cases of severe type the areas of softening and the hæmorrhages are of greater extent.

Symptoms. The onset of the disease is usually sudden, with headache, dizziness, nausea, vomiting and a chill followed by a rise in temperature to 103° to 105° F. (39.5° to 40.5° C.). The pulse and respiration are accelerated and symptoms of cerebral irritation, such as convulsions, photophobia and delirium, may occur; later these disappear and the patient becomes stuporous or relapses into a state of partial coma from which he can, however, be aroused. The neck is not stiff nor are the pupils contracted. The patient may lie in this condition for a number of days, the symptoms may abate and gradually disappear, recovery supervening, or he may relapse into a state of coma and finally die.

Focal symptoms depending upon the part of the brain affected are common; these may be paralyses of an arm or leg, hemipelgia, hemianopsia, aphasia, optic paralysis, nystagmus, speech disturbances, etc.

After recovery permanent disabilities of brain function often remain.

The prognosis is serious but by no means do all instances result fatally or in permanent cerebral impairment.

Treatment. The patient should be confined to bed in a darkened room; the bowels should be moved by means of repeated small doses of calomel—gr. $\frac{1}{4}$ (0.016)—or a saline. Aconite, in doses of from 5 to 10 drops (0.33–0.66) every two to four hours, should be given to lessen the fever and the circulatory excitement. An ice cap should be applied to the head and leeches to the nuchal region and the temples. The restlessness may be relieved by the bromides or hydrated chloral; opium and morphine seem to be ineffectual. In the later stages cardiac weakness may be combated by the use of strychnine.

During convalescence general tonic treatment is indicated with the addition of the syrup of hydriodic acid, one drachm (4.0) or potassium iodide, gr. x (0.66) three times a day in order, if possible, to aid the absorption of the exudate and lessen the tendency to sclerosis.

The diet during the acuity of the attack should be entirely fluid and feeding by gavage or *per rectum* may be necessary.

CEREBRAL MENINGITIS.

PACHYMENINGITIS.

EXTERNAL PACHYMENINGITIS.

Definition. An inflammation of the external surface of the dura mater of the brain.

Ætiology. This condition results from necrosis of the bones of the skull, such as occurs in mastoid or middle ear disease, in chronic nasal inflammations and in syphilis of the cranial bones. It may also follow fractures of the skull and erysipelas.

Symptoms. These are often obscure; there are usually headache, abnormally high temperature, delirium, convulsions, and the symptoms of increased intracranial pressure due to the pressure of the inflammatory exudate. This is usually purulent and is occasionally of sufficient amount to cause paralyses; in severe cases the infection may extend to the pia mater.

Treatment consists in the proper management of the causative factor and in the relief of the pressure by means of operation.

INTERNAL PACHYMENINGITIS.

Synonyms. Pachymeningitis Hæmorrhagica; Hæmatoma of the Dura Mater.

Definition. An inflammation of the inner surface of the dura characterized

by the production of new tissue which is rich in blood-vessels, the walls of which easily rupture with resulting hæmorrhage.

Ætiology. The disease is rare; it is seen more usually in males of middle age or over but occurs occasionally in children. The chief cause seems to be chronic alcoholism; it has also been observed in insanity, general paralysis, after the acute infectious diseases, in tuberculosis and syphilis and associated in mild form with chronic cardiac, pulmonary or renal conditions.

Pathology. The inflammation usually begins somewhere in the distribution of the middle meningeal artery as a congestion and extends from this point; layers of false membrane are formed which is thickly reticulated with dilated and tortuous blood-vessels, the walls of which are frequently subject to rupture with consequent hæmorrhage varying from mere traces of blood to extravasations of considerable size. The amount of blood seen on necropsy may be greatly in excess of that of the new-formed tissue, or the opposite condition may obtain; both the new tissue and the extravasated blood may degenerate; in the former the blood-vessels are obliterated and the blood itself becomes decolorized and at times is partly absorbed. Suppuration is a rare complication.

Symptoms. In many cases these are obscured by the co-existent insanity or mental abnormality. There may be headache, vomiting, muscular weakness and signs of cerebral compression evidenced by convulsions, nystagmus, stupor, coma, optic neuritis, or partial paralyses. Seizures resembling apoplexy may occur with the incidence of fresh hæmorrhagic extravasations.

The prognosis is unfavorable in the extreme.

Treatment consists in combating the symptoms as they arise, keeping the patient quiet in a darkened room, elevating the head and in the application of the ice helmet.

Suppurative and pseudo-membranous inflammations of the internal surface of the dura resulting from injury, from extensions of adjacent inflammatory conditions and as complications of the infectious diseases are seen but their symptoms are so obscure as to prevent their recognition during life.

LEPTOMENINGITIS.

Definition. An inflammation of the pia mater and the arachnoid membrane characterized by an exudation between these two structures.

Ætiology. The disease is most often seen in young children and as a complication of the acute infectious diseases, pneumonia, influenza, smallpox, measles, scarlatina, enteric fever, and septic conditions. The exciting cause is a pathogenic micro-organism of almost any variety which obtains entrance to the skull by means of the blood current, as a result of diseases of the cranial bones—for instance petrous necrosis following otitis—through the cribriform plate of the ethmoid bone or through any other opening in the skull.

Pathology. The condition may be localized or diffuse and affects the basilar portion of the brain more often than the convexity; it may spread to the ventricles. The membranes are first swollen and hyperæmic, then cloudy in appearance and finally become infiltrated with sero-purulent or purulent fluid. The process may spread to the dura mater or to the cerebrum itself.

Symptoms. The prodromata of this condition are headache, general malaise, dizziness, nausea and vomiting; after a few days signs of irritation appear, such as a continuance of the headache and *projectile* vomiting, convulsions, an irregular temperature, 101°–103° F. (38.5°–39.5° C.), photophobia, unequal and contracted pupils, hyperæsthesia of the skin, retraction of the abdomen and stiffness of the neck; there may be low muttering delirium or alternating delirium and stupor. The pulse is usually irregular and weak, its rate may be slow (60–70); the respiration is accelerated and irregular; the bowels are constipated; as the disease progresses the symptoms become more marked, there may be general rigidity and optic neuritis. As the stage of paralysis sets in the pupils become dilated, there may be facial paralysis, ptosis or strabismus, the abdomen becomes still more "boat-shaped," coma is present, the intestine and bladder are incontinent; death supervenes within a few days as a rule.

Basilar meningitis is characterized by paralyses of the cranial nerves, optic neuritis and rigidity of the neck, while if the inflammation is confined to the convexity, the delirium, convulsions and paralyses are more marked.

The diagnosis. The employment of lumbar puncture has proved a great aid in the diagnosis of this condition. The character of the fluid withdrawn by this means in inflammations due to other causes than tuberculosis, is purulent, although pus in the latter case may sometimes be withdrawn. The only pathological condition in which the fluid remains clear is tuberculosis; the existence of disintegrated blood is evidence in favor of pachymeningitis or trauma, while fresh blood appears as a result of the passage of the needle through the tissues of the back. Cytological and bacteriological examination of the fluid throws further light upon the cause of the process. The fluid may be strained after centrifuging or cultures may be made. The finding of the bacillus tuberculosis settles the diagnosis, but failure to isolate does not disprove the possibility of this organism as the causative factor.

Other micro-organisms, such as the pneumococcus, staphylococcus, streptococcus, etc., may be found. A differential estimation of the leucocytes contained in the fluid is useful; the mononuclear lymphocytes are usually relatively increased in tuberculous conditions while in inflammations due to other causes there is likely to be a preponderance of the polymorphonuclear leucocytes. Normal cerebrospinal fluid contains a small amount of sugar while inflammatory exudates are free from this substance.

The prognosis. The disease lasts from a few days in very acute instances

to several weeks in those of slower course. The prognosis is grave at best but not necessarily entirely unfavorable.

Treatment. Prophylaxis consists in the antiseptic treatment of cranial injuries and early operation with proper after-treatment of otitic conditions. Rest in a darkened room should be insisted upon and an ice helmet applied. The bowels should be kept open by means of calomel. For the pain the coal tar analgesics, acetanilide gr. v (0.33), acetphenetidine gr. x (0.66) or antipyrine salicylate (salipyrine) gr. x (0.66) may be given, but in severe types opium may be necessary. The use of iodoform internally and externally has been recommended; 6 to 10 grains (0.4–0.66) per day may be given or an ointment of 20 percent. strength may be rubbed into the shaven scalp; potassium iodide in doses of 10 grains (0.66) three times a day should be given and hot applications—poultices or wet compresses—to the upper spine, and leeches to the temples and neck are useful. The inunction of mercurial ointment to the limit of tolerance in non-tuberculous cases has its advocates.

The delirium and other symptoms of nervous hyperæsthesia may be controlled by the bromides and hydrated chloral, and good results have followed the relief of the intra-cranial pressure by means of lumbar puncture; rarely a single puncture with the withdrawal of from 8 to 10 drachms (30.0–37.50) of the fluid will result in recovery. If necessary the procedure should be repeated at daily or at longer intervals; the amount withdrawn at a single puncture should not be larger than that above specified.

The diet should be of milk, other like fluids and broths.

TUBERCULOUS MENINGITIS.

Synonym. Acute Hydrocephalus.

Definition. An acute inflammation of the meninges due to infection by the bacillus tuberculosis.

Ætiology. This disease occurs chiefly in children from two to ten years old; it is sometimes seen in young infants but rarely in adults. Its predisposing causes are the tuberculous diathesis, poor hygienic conditions of life and the presence of tuberculous processes in other parts of the body. It may follow an attack of any infectious disease especially measles, and milk from tuberculous cows may be an exciting cause.

Pathology. In cases of very acute course the brain is the seat of marked congestion and there are miliary tubercles scattered over the pia mater of both the base and the convexity. In other cases the tubercles are also found at the base and the convexity, in the ventricles, the choroid plexus and often in the spinal meninges; they are most abundant in the neighborhood of the smaller blood-vessels, and larger tuberculous deposits in which bacilli are

found, may occur as a result of the coalescence of a number of tubercles. There may be areas of softening due to the obliteration of the vessels by the products of the inflammation. There may be deposits of fibrin, the arachnoid fluid is usually increased and this may also be true of that in the ventricles, which at times may become so abundant as to compress the cerebral substance.

Symptoms. Those of the prodromal period are headache, irritability, dizziness, prostration, anorexia, projectile vomiting without nausea, and constipation; rarely do paralyses of the facial muscles appear in the prodromal stage. These symptoms may exist for several weeks before the appearance of the true stage of irritation; this is characterized by an accentuation of the symptoms already present, the *tache cérébrale*, inequalities of the pupils, photophobia, convulsions, delirium, paralyses, etc., as already described in the section on leptomeningitis. Succeeding this appears the comatose stage, with the accompanying evidences of cerebral compression.

The diagnosis. Lumbar puncture is a great aid in diagnosis; tuberculous exudates usually do not contain an excess of polymorphonuclear leucocytes, sugar is likely to be present, while in other forms of meningitis its absence is the rule, and the albumin content of the fluid is less reduced in the tuberculous exudate than in those of other origin. The presence of the tubercle bacillus assures the diagnosis, but its absence does not rule out tuberculous infection as a causative factor. Indicanuria may occur (Hochsinger's sign).

The prognosis is distinctly bad, death usually supervening in three or four weeks.

Treatment consists in the employment of the measures suggested under the treatment of leptomeningitis (p. 729).

CHRONIC HYDROCEPHALUS.

Definition. A condition characterized by gradual enlargement of the head due to the accumulation of serous fluid in the ventricles of the brain.

Ætiology. The disease occurs in a large majority of instances in early infancy, often being congenital. Predisposing causes are poor bodily condition, unhealthful surroundings, rhachitis and parental alcoholism, plumbism or syphilis.

Pathology. The serous exudation which characterizes this disease is the result of congenital or inflammatory obstruction of the aqueduct of Sylvius or of the foramen of Magendie and the lateral foramina. As a consequence of this the ventricular fluid is retained and, continually increasing, causes distention and pressure. The lateral ventricles, one or both, are the most frequent seats of this distention which may be so extreme as to compress the cerebral cortex to the thinness of half an inch or less. More rarely does the distention affect only the fourth ventricle.

Symptoms. In congenital instances the size of the head may be so great as to necessitate instrumental delivery or even craniotomy. When the disease appears after birth the size of the head gradually increases, the frontal and occipital regions bulge, the fontanelles and sutures bulge and spread and the presence of fluid may be detected by palpation. The facies does not increase in size correspondingly; as the condition becomes more marked, mental symptoms appear; the child is easily irritated; both mental and physical growth are delayed. In the severe instances the child may not learn to walk or talk, the intracranial pressure results in optic atrophy or strabismus, there are vomiting and convulsions; coma may supervene and death from asthenia or intercurrent disease results, although this event may not take place for several years. In instances of less severity the progress of the condition ceases, the cranial bones unite and become hard and firm and the mental and physical processes become normal.

Chronic hydrocephalus occurring later in life is evidenced by vague symptoms of compression and is difficult of recognition.

Treatment is unsatisfactory; the symptoms should be met as they arise and, upon the possibility of syphilis being the causative factor, inunctions of mercury and the internal administration of potassium iodide should be prescribed. Surgical and other measures are of little value. Lumbar puncture will relieve the pressure temporarily but the fluid returns.

APOPLEXY.

CEREBRAL HÆMORRHAGE.

Definition. Apoplexy is the term applied to the train of symptoms which follows the rupture of an intracranial blood-vessel or that which results upon embolism or thrombosis of these structures.

Ætiology. Cerebral hæmorrhage is seen rather more frequently in males than in females and is most common in individuals beyond middle life. This is the case merely because arterial degeneration affects men more often and occurs chiefly in those over 40. The kidneys are diseased in a large number of instances and as predisposing causes syphilis, alcoholism and gout play an important rôle. An artery weakened by injury or chronic inflammation may at any time rupture as a result of increased blood pressure, which condition may be due to emotional or sexual excitement, straining at stool, an undue physical effort, alcoholic excess, over-eating, etc.

Pathology. The morbid anatomy of cerebral hæmorrhage before actual rupture takes place is that of arteriosclerosis (p. 606); there are roughening of the intima, fatty degeneration of the muscular coat and fibrous changes in the externa. Miliary aneurysms are found upon the smaller arteries as a

result of the degeneration of the artery wall; atheromatous changes affect the larger arteries. The vessel which most frequently ruptures is the lenticular striate branch of the middle cerebral artery, consequently cerebral hæmorrhage is most usually seen in or near the caudate and lenticular nuclei. The branches of the anterior cerebral artery rupture less often and those of the posterior cerebral, rarely. The reason for the election of the middle cerebral is that this vessel seems more prone to degenerative changes than the others and that it is in more direct communication with the heart; consequently it receives the blood under greater pressure than do the other vessels mentioned. Large hæmorrhages and those under high pressure may burst through into the ventricles and reaching the fourth ventricle, result in death from pressure upon the centers there situated. The fourth ventricle is especially likely to be affected in cerebellar hæmorrhage. After extravasation the blood first coagulates; the clot then softens and absorption begins; in about a week a wall of fibrin is formed about the clot which becomes encysted within its fibrinous wall, contraction of the cyst wall finally taking place.

Symptoms. Prodromal symptoms such as a feeling of fulness in the head, dizziness, numbness and tingling of an extremity, ringing in the ears, irregular heart action, etc., may occur; the usual onset of a "stroke" is evidenced by sudden loss of consciousness; if standing, the patient falls; more rarely is an attack ushered in by convulsions and a seizure may take place without coma. After the typical onset the patient is seen in an absolutely comatose state, his face is flushed, cyanotic or pale, the pulse is of high tension and usually slow, the respiration is slow and stertorous; it may be irregular and expiration is accompanied by an inflation of one cheek. The pupils may be contracted, dilated or unequal but they usually do not respond to light. At the time of the attack the temperature falls to a subnormal level—later it rises.

Examination usually reveals a paralysis, most frequently a hemiplegia with lack of sensation, the arm and leg if raised fall limply, rarely are they rigid; the reflexes are lost or very greatly diminished; the tongue protrudes toward the paralyzed side. After the return of consciousness, when the right side is affected, there is inability to speak (aphasia—see p. 737). The bladder and rectum may be incontinent or there may be retention of urine; examination of the latter often shows the presence of albumin.

In the rapidly fatal instances there may be no return to consciousness, the pulse becomes more rapid, the respiration may change to the Cheyne-Stokes type, the temperature rises to 103°–104° F. (39.5°–40.° C.) and death supervenes; just before death the temperature may fall. In fatal instances of slower course the coma partially disappears, giving way to stupor or delirium, the temperature remains only slightly elevated, being higher upon the affected side; hypostatic pneumonia may develop, to be followed by death after a few weeks.

The patients who go on to the chronic stage gradually regain sensibility,

the aphasia partially or wholly disappears and the paralysis slowly improves to the extent that the affected limbs can be slightly moved and sensation is partly regained; the mind may be permanently impaired.

The patient has now become a hemiplegic; the facial muscles are least disturbed, those of the arm most, those of the voice and of the chest are very little affected; the knee and ankle jerks are exaggerated. Contractures with resulting deformity are developed; these involve the extensors of the foot more than the flexors, while the opposite is the case in those of the upper limb. There is no atrophy of the muscles and while their electrical reaction is disturbed, the so-called reaction of degeneration does not result. Various motor disorders may develop; tremors, choreic, athetoid, and ataxic movements, etc. Complete anæsthesia is seldom seen but paræsthesiæ are frequently observed. Trophic and vaso-motor disorders, such as swelling of the extremities, sweating and skin eruptions, may occur. The nutrition usually continues good but in patients who are confined to the bed, bed-sores are very prone to develop. Progressive emaciation is rare.

The diagnosis of cerebral hæmorrhage is often most difficult. A considerable number of conditions must be differentiated from it; among these are the following:

Alcoholic coma. In this state the insensibility is less complete, the patient may be aroused by the inhalation of ammonia or by pressure upon the supra-orbital nerves; the pulse is rapid, the temperature is not subnormal, one cheek is not inflated and drawn in with respiration, there are no signs of paralysis, the pupils are equal and reactive and the odor of the breath is characteristic.

Opium poisoning. The onset of the coma is gradual, the pupils are contracted and equal, the temperature is normal, the respiration slow, there is no paralysis, the patient may be partially aroused and the examination of the stomach contents is characteristic unless the drug has been taken hypodermatically; in this case the needle puncture may be found. There is no paralysis.

Uræmic coma. Here we may have a history of antecedent convulsion, there may be œdema and the waxy skin of the large white kidney, the pupils are equal and the urine contains albumin and casts; the pulse is usually weak and irregular and the respiration rapid. The evidences of pregnancy are a strong point in favor of uræmia.

Epilepsy. The coma is preceded by the characteristic cry, there is a history of previous attacks, there is frothing at the mouth; the tongue may be bitten, the pupils are equal and dilated and there is no paralysis.

Cerebral embolism. This is more likely to occur in young individuals, there often is evidence of valvular heart lesion; the coma is slighter in character and shorter in duration, the paralysis usually appears first and is followed by the convulsion and the loss of consciousness. Seizures after child birth

are more likely to be due to embolism. There is little disturbance of temperature, and the tense pulse and stertorous breathing are absent.

Cerebral thrombosis. Here we may have a history of light attacks from which recovery is quick; the patient is usually aged and presents the signs of atheroma; convulsions, stertor and abnormal temperature are wanting. The pupils are usually undisturbed.

Treatment. The patient should be immediately placed in a horizontal position, but with the head elevated. An ice bag should be applied to the head and hot water bags to the feet. The lower limbs may be wrapped in towels saturated with hot mustard water—a tablespoonful (15.0) of mustard to 2 quarts (litres) of water. If the pulse is of markedly high tension about 8 ounces (250.0) of blood should be drawn from one of the median basilic veins. The bowels should be moved by an enema of warm water and a purge administered; those preferable are croton oil, 1 or 2 drops (0.065–0.13) mixed with a little olive oil and placed at the back of the tongue or elaterium, gr. $\frac{1}{5}$ to gr. $\frac{1}{4}$ (0.008–0.016) on account of their ease of administration and rapid action. In moderate degrees of vascular tension, even after venesection, aconite or veratrum viride—the tinctures in doses of 1 drop (0.065) every 30 minutes—should be given until the tension becomes lower. Compression or ligation of the carotid artery has been advocated with a view to lessening the hæmorrhage. The bladder should be watched and the urine drawn if necessary.

Following the treatment of the seizure, measures should be taken to preserve the nutrition of the patient; rectal feeding may become necessary. Bedsores should be prevented by attention to the cleanliness of the bed, and of the patient's skin. The buttocks and heels should be rubbed with alcohol and powdered daily and the sheets should be kept as smooth as possible. The patient should be frequently turned upon his sides both to guard against bedsores and against hypostatic pneumonia, additional points in the prophylaxis of which are frequent thorough cleansing of the mouth with an antiseptic solution and care lest particles of food be breathed into the lungs.

The treatment of the chronic stage consists in the internal administration of sodium or potassium iodide, together with general tonics, such as iron, strychnine and quinine, and attention to the action of the bowels and kidneys. Arterial tension when it occurs should be relieved by means of glyceryl nitrate gr. $\frac{1}{100}$–$\frac{1}{50}$ (0.0006–0.0012) every four to six hours. Several weeks after the attack the use of the faradic current upon the affected muscles should be begun and continued at daily intervals, later static electricity is also beneficial. Massage and exercises adapted to the patient's abilities are important and warm baths are useful. The physical means above mentioned are effectual both in the prevention of contractures and in the maintenance of muscular nutrition. The administration of small doses of strychnine—gr. $\frac{1}{120}$ to

$\frac{1}{100}$ (0.0005–0.0006), of physostigmine salicylate gr. $\frac{1}{100}$ to $\frac{1}{60}$ (0.0006–0.001) and of the bromides is said to be attended with good results when contractures are present.

The mode of life should be regular and quiet, a temperate climate is preferable and the diet should be simple.

In cases of fracture and where there is reason to suspect a cortical or meningeal hæmorrhage, trephining of the skull and relief of the pressure is justifiable and the results obtained are often excellent.

EMBOLISM AND THROMBOSIS OF THE CEREBRAL ARTERIES.

Synonym. Acute Cerebral Softening.

Definition. Embolism is the term applied to the plugging of a blood-vessel by a clot or other foreign body brought to its place of lodgment by the blood current.

By thrombosis is meant the stoppage of a blood-vessel by a clot developed *in situ*.

Ætiology. Embolism is seen somewhat more often in females, thrombosis in males; embolism may occur in children or young persons while thrombosis is rare before middle life. Predisposing causes are acute or chronic valvular heart lesions, aneurysm, endarteritis, blood diseases, acute infectious diseases and pregnancy. The embolus is carried by the most direct route to the cerebral circulation, i.e., through one of the carotids, more particularly the left, to the internal carotid and thence to the left middle cerebral artery, or less frequently to the posterior cerebral branch of the vertebral artery.

Thrombosis is predisposed to by arteritis due to any cause, weak or fatty heart and blood dyscrasiæ; carotid ligation may be followed by cerebral thrombosis. The vessel most frequently involved is the middle cerebral; the basilar artery is a not uncommon situation for thrombosis; less often is there obstruction in the vertebral and posterior cerebral arteries and in one of the various branches of the circle of Willis.

Pathology. The stoppage of the blood current by the embolus or thrombus deprives a certain area of the brain of its blood supply. Degeneration and softening of this area begin usually in about twenty-four hours. If in the gray matter, the tissue supplied by the occluded vessel becomes red (red softening) and later yellow (yellow softening). The area of softening is finally absorbed, a scar or a cyst remaining, unless the embolus is infective, when local inflammation or abscess may result. The arteries in cases of thrombosis usually give evidence of endarteritis affecting chiefly the cerebral arteries, anterior, middle and posterior, as well as the vertebral and basilar arteries. Post-thrombotic softening is analogous to that following embolisn and the two conditions may co-exist owing to the detachment of a bit of the clot and its

subsequent lodgment; rupture of one of the cerebral vessels may follow either thrombosis or embolism.

Symptoms. Both embolism and thrombosis may take place without causing recognizable symptoms if the condition occurs in a vessel possessing free anastomoses, since a collateral circulation is immediately set up. When, however, there is a stoppage in a terminal artery the picture is a markedly different one. Prodromal symptoms seldom occur in embolism. The onset may be marked by slight muscular twitchings with subsequent coma and hemiplegia, the two latter manifestations alone may appear, or the coma may be entirely absent. The suffused facies, stertor and arterial tension characteristic of hæmorrhage are absent. Vomiting is a rare symptom.

Prodromata are the rule in thrombosis; headache, dizziness, disturbances of the cranial nerves, numbness and tingling of the extremities, and temporary paralyses or aphasia may be observed. Here the coma and hemiplegia are of gradual development in most instances but these symptoms may appear suddenly; the coma may be wholly lacking. The temperature is not markedly disturbed but may be subnormal at first; it may rise later. When a terminal vessel is not involved the paralysis soon begins to improve, owing to the establishment of a collateral circulation.

In marked instances with considerable areas of softening the patient may die within a day or two; death in less severe cases may not take place for a number of weeks or the patient may pass on to the chronic stage, a state closely allied in symptoms to that following cerebral hæmorrhage.

The differential diagnosis has been discussed upon p. 733.

The prognosis in embolism is good, as a rule, as regards recovery unless the obstruction has lodged in a very large artery, when the condition ends in death. Recurrences in both embolism and thrombosis may occur, more commonly in the latter and each attack is more serious than the preceding. The prognosis of the chronic stage is poor, as regards recovery, in both conditions.

Treatment. The patient should be put to bed with his head elevated. Venesection is contraindicated but the heart action should be stimulated if necessary by means of glyceryl nitrate, digitalis or strophanthus; the two latter are particularly indicated in embolism, the first in thrombosis. Potassium iodide is also useful in relaxing arterial tension and is likely to be more permanent in its effect than glyceryl nitrate. The dose of the former is 10 grains (0.66) or more, that of the latter, gr. $\frac{1}{100}$ to gr. $\frac{1}{50}$ (0.0006–0.0012) three times a day. The action of the bowels and kidneys should be maintained in as nearly a normal state as possible. When there is possibility of a syphilitic element in the ætiology of the condition treatment by means of mercury and the iodides should be at once instituted.

The management of the chronic stage is identical with that of the corresponding state in cerebral hæmorrhage. (See p. 734.)

THROMBOSIS OF THE VENOUS SINUSES OF THE BRAIN.

Sinus thrombosis occurs in both a primary and a secondary form. The former is seen in states of poor bodily nutrition and weakened conditions. It may take place in infants as a result of chronic wasting diseases, especially in diarrhœal conditions, it may result from various blood dyscrasiæ, and may complicate such constitutional diseases as tuberculosis and cancer.

Secondary thrombosis is observed as a complication of various inflammatory conditions in the neighborhood of a sinus, such as internal ear and mastoid disease, fractures of the skull and any suppurative process.

Symptoms. Primary thrombosis may be attended by few or no symptoms; those most frequently seen are headache, nausea, vomiting and coma of very gradual development. Paralyses and pupillary dilatation are more rare.

Secondary sinus thrombosis is preceded by otitis, cranial fracture, etc., and their attendant symptoms; its nature is infective and it is usually ushered in by a chill followed by a rise in temperature. There is severe occipital headache, the patient may be stuporous or delirious, and convulsions may take place as well as the other symptoms of meningeal inflammation. The sinuses involved are usually those in the neighborhood of the ear.

The prognosis is serious, death in the secondary form usually occurring after two or three weeks and often being due to septic pneumonia, which has its origin in emboli brought from the affected sinus to the lung by the venous circulation.

Treatment consists, in the primary form, of such measures as are called for by the causative factor; in the secondary variety surgical procedures must be employed with a view to the removal of the septic focus. For a description of these the reader is referred to works upon surgery and operative otology. After treatment calculated to improve the patient's general condition —quinine, iron, strychnine, etc.—should be employed.

APHASIA.

This is the term applied to defects or loss of the power of speech; aphasia occurs in various forms differing with the part of the speech mechanism affected. In considering aphasia we include the faculty of transmitting to others our thoughts by spoken or written words and by gestures, as well as the faculties by which we see, hear and realize the significance of objects. Aphasia is regarded as sensory or motor according as it is the result of inability to remember words or to speak them, consequently it may be caused by disorder of either the receptive or the emissive center.

Sensory aphasia. Under this term we include word blindness, word deafness and amnesic aphasia. Word blindness is the term applied to failure

to remember the appearance of a word. The patient afflicted with this condition does not recognize the written or printed word while he may be able to pronounce it when repeated by another, to copy it or to write it from dictation; the memory for figures, however, may remain normal. Motor aphasia may co-exist with this affection and the portion of the brain at fault is believed to be some part of the left angular or supramarginal convolution.

Word deafness is a condition in which, while the sense of hearing remains undisturbed, the meaning of words is lost; musical tones also may be unrecognized. This is a rare affection and is usually accompanied by other varieties of sensory aphasia although it may occur independently. The part of the brain affected is the posterior part of the first and second left temporal convolutions in right-handed individuals and a corresponding area on the right hemisphere in the left-handed.

Amnesic aphasia is a state in which the patient is unable to remember a word; if it is supplied to him he recognizes and repeats it. He may be thus affected as regards all words or only a few, perhaps but a single one, his name for instance.

Agraphia is an analogous condition in which the patient is unable to write a word because he cannot remember it; he can, however, usually write at dictation.

These last two affections are probably caused by a disturbance of the association tracts.

Motor or ataxic aphasia. In this disorder the patient is quite aware of the word he desires to say but is wholly unable to say it, neither can he, if it is supplied by a second person, repeat it. If he is a linguist he may lose the power of all tongues save one; he may be able to read to himself and understand the speech of others while entirely unable to speak himself, or while able to articulate a few words, he may mispronounce these or leave out syllables or letters. In this condition the lesion is in the third left frontal convolution and consequently is a frequent accompaniment of right hemiplegia. Alexia, or lack of the power to read aloud, is usually an accompaniment of this form of aphasia.

Atypical and mixed forms of aphasia are not unusual, a patient sometimes using the wrong word to express an idea because of a confusion of thought.

GENERAL PARALYSIS.

Synonyms. General Paresis; Dementia Paralytica; Chronic Diffuse Meningo-encephalitis; Paretic Dementia.

Definition. A chronic progressive inflammatory disease of the central nervous system, especially of the cerebrum and its pia mater, resulting in loss of mental and physical power and ending in insanity and paralysis.

Ætiology. This disease is one of middle life and is more common in males, although it has been observed in congenitally syphilitic children. The chief causative factor is specific disease, syphilis being responsible for at least 75 percent.—perhaps a much greater proportion—of all cases. It is a disease of the higher classes of society and is predisposed to by excesses of every variety, mental over-work and worry.

Pathology. The gross changes seen in the brain consist of atrophy, particularly involving the frontal lobes; their color is lighter and their texture more firm than normal, the convolutions are shrunken, the fissures widened, cysts may be present in both white and gray matter; there is also thickening of the dura mater and of the pia. The latter is œdematous and may be adherent to the brain. Upon microscopical examination the walls of the blood and lymph vessels are seen to be thickened, the hypertrophy of the former resulting in fusiform dilatations, and there is exudation of serum into the lymph spaces, resulting finally in an œdema of the cerebrum. The nerve tissue itself is destroyed and replaced by neuroglia. The cerebral neurons are the seat of degeneration and finally atrophy. These changes affect the cerebral ganglia as well as the white and gray matter.

Sclerotic changes of the cord, analogous to those of tabes, particularly in the posterior and lateral columns, are also present.

Symptoms. Those of the first stage or that of onset, may last for months or even a year or more and are both mental and motor in character. The patient is subject to delusions of grandeur accompanied by unusual actions, loss of memory and lack of judgment. He may indulge in extravagant financial operations and make impossible promises or contracts; he may be irritable and easily excitable or morose, and despondent; he may suffer from insomnia. The motor disorders chiefly affect speech and handwriting. The former becomes hesitating and indistinct, syllables and words may be slurred and difficulty is experienced over complicated phrases such as "third artillery brigade" and "around the rough and rugged rocks the ragged rascal ran." The handwriting is shaky, syllables are omitted, words mispelled and wrong letters inserted

The pupils may be unequal, the patellar reflex may be absent in cases with sclerosis of the posterior columns of the cord or it may be exaggerated in spastic cases.

In the second stage the above symptoms are more intense, the mental state may be violent or maniacal and the delusions more extraordinary, or, on the other hand, the depression may become more marked, even to pronounced melancholia, and the physical condition becomes much deteriorated. There is progressive increase of the disturbance of speech and handwriting, the former may become entirely incomprehensible and the power of writing entirely lost. Epileptiform and apoplectiform seizures may occur, the gait is disor-

dered, and mono- or hemiplegia may develop. Ataxia, loss of sensation and paralysis of bladder and rectum are not infrequent. Bulbar symptoms follow and the patient becomes helpless, the loss of mental power is complete and death supervenes from exhaustion or from concurrent disease.

The course of general paralysis is usually from three to six years but a type of rapid course is met in which the stages are shortened to a few months; here the loss of flesh and strength takes place very rapidly.

The prognosis. While encouraging remissions in the development of the symptoms occur at times the disease is bound to progress and the ultimate fatal result is certain, consequently the prognosis as to recovery is wholly bad.

Treatment. Institution treatment where a properly hygienic mode of life can be carried out, with plenty of fresh air, bathing and massage, should be insisted upon. While the action of anti-syphilitic treatment is in no sense specific, it may lessen the rapidity of the progress of the disease and in view of the frequency of a luetic element in the ætiology, a course of treatment by inunctions of mercury and the internal administration of potassium iodide in increasing doses even up to 100 or more grains (6.66) per day, should be instituted.

Otherwise the treatment should be such as to combat the symptoms as they arise; the excitability may be relieved by the bromides; for the sleeplessness the milder hypnotics such as sulphonmethane—gr. xx (1.33)—sulphonethylmethane—gr. x (0.66)—or veronal—gr. x to xv (0.66-1.0)—are indicated. The attacks of marked delirium may necessitate the administration of hyoscine hydrobromide, gr. $\frac{1}{100}$ (0.0006) hypodermatically. The bowels should be kept open by laxatives if necessary and the patient's nutrition maintained by means of a nourishing and easily digestible diet.

DISSEMINATED SCLEROSIS.

Synonyms. Multiple Sclerosis; Insular Sclerosis; *Sclérose en Plaques.*

Definition. A chronic inflammation of the central nervous system characterized by the development of patches of sclerosis in various parts of the brain and cord.

Ætiology. The direct causation of this condition is unknown. It is seen in both sexes with equal frequency, and, while it may occur at any age, is rare in childhood and most common between the ages of twenty and forty. It is said to follow the acute infectious diseases and also to result from exposure to cold, emotional disturbances and syphilis.

Pathology. Throughout the brain and spinal cord are irregularly scattered patches of sclerosed tissue. These are grayish in color and firm in consistency; their outline is irregular and distinct and their diameter may be $\frac{1}{16}$ of

an inch or more. They are rarely seen in the cortex, their usual sites in the brain being about the lateral ventricles, the corpus callosum, the pons and the cerebellum; they are infrequent in the pons but many may be found in the cord, particularly in the white matter. The type of the sclerosis is analogous to that occurring in other tissues; the neuroglia is increased at the expense of the nerve cells and fibres and the walls of the blood-vessels are thickened. When the process is advanced the nerve cells themselves become degenerated and fatty granular cells may be present. In the nerve fibres the white substance is first involved, later the axis cylinder, which ultimately is wholly destroyed; this latter, however, is a late change, the axis cylinders remaining intact long after their sheaths have succumbed to the sclerotic process.

Symptoms. The occurrence of this disease with other lesions, together with its slow development, renders its recognition difficult. The symptoms depend upon the portions of the nervous system involved in the sclerotic process. An important early symptom is an ataxia of the limbs, resembling, in the legs, the symptoms of spastic paraplegia with stiff and awkward gait, showing that the pyramidal tracts are affected, here we find the patellar reflex and the ankle clonus increased. The so-called intention-tremor is a typical symptom manifesting itself by an incoördination of the hands, a marked tremor being observed when the patient lifts a glass to the mouth or tries to pick up a small object; the tremor ceases when the patient desists from his endeavor. A like tremor affects the head and trunk. The Romberg symptom may be present. Nystagmus and various ophthalmic disturbances are common; these are due to sclerotic patches in the optic nerves or chiasm, and consist of optic atrophy, amblyopia, loss of color sense, etc.; the Argyll-Robertson pupil may be present.

The speech is characteristic, being the so-called syllabic utterance or scanning speech, in which the syllables are separated by prolonged pauses; the protruded tongue trembles and there may be difficulty in swallowing.

While varying degrees of hemiplegia are not uncommon, there is no muscular atrophy; disturbances of cutaneous sensation are rare and if present are very slight.

Headache and dizziness are sometimes observed and apoplectiform or epileptiform attacks may occur. The mind is little if at all disordered, although the memory may be slightly impaired; the intellect is sometimes dull and there may be paroxysmal attacks of laughing or weeping.

Vesical disturbance and sexual weakness are not uncommon.

The course of the disease is variable, at times steadily progressing for a year or two until it reaches a more or less permanent stage which may last for a number of years; at other times the course may be characterized by remissions but there is no hope of ultimate recovery.

The prognosis as regards the patient's life is most serious in those cases in which the sclerosis affects those portions of the nervous system in which the vital centers are located—particularly the pons and medulla.

Treatment. We have no means by which we can check the development of or cause to disappear the sclerotic patches; consequently the treatment is chiefly symptomatic and sustaining. The administration of mercury and potassium iodide should be instituted in all instances and may even benefit patients in whom there is no history of syphilis. The hypodermatic employment of arsenic and the use of silver nitrate internally have been recommended.

Tonics should be prescribed and the patient should lead a quiet, regular life in accordance with the rules of general hygiene; his diet should be nourishing and easily digestible. Massage, exercises, hydrotherapeutic measures and electricity may prove useful both in treating the disease and in giving the patient something to take his mind from his condition.

ABSCESS OF THE BRAIN.

Synonyms. Suppurative Encephalitis; Cerebritis.

Definition. A collection of pus or purulent fluid within the substance of the brain or between it and its meninges.

Ætiology. Like abscesses of other parts, those of the brain are the result of bacterial infection. The pathogenic micro-organisms find lodgment as a result of a traumatism, as a result of an adjacent purulent process spreading to the brain tissue or they may be brought from a distance by the blood stream as in pyæmia.

Males are most frequently affected and the most susceptible age is between ten and forty years.

Following injury, such as a compound cranial fracture, the abscess may develop as a result of infection of the open wound; after *contre coup* fractures the abscess may involve the tissues opposite or beneath the site of the trauma.

The most frequent cause of brain abscess is middle or internal ear disease, especially when the tympanic cavity or mastoid cells are affected. Infective processes of the nasal and orbital cavities also may result in brain abscess.

Pyæmia is a much less frequent cause; malignant endocarditis, tuberculous inflammations of the lungs, empyema, hepatic abscess, gangrene of the lungs, etc., may produce abscess of the brain and the condition may complicate the infectious fevers, enteric fever, smallpox, epidemic influenza, erysipelas and the like.

Pathology. There is usually but one abscess although there may be two or more. The most frequent location for those resulting from injury is in the frontal or temporal lobes, those from nasal or orbital disease in the frontal

lobe, those from otitic inflammations in the cerebellum; embolic abscesses are most commonly situated in the parts supplied by the middle cerebral artery. The first change is a marked congestion which results in *red softening*. The process continuing, the tissues become infiltrated with inflammatory exudate and leucocytes. The resulting pus is greenish-yellow in color and of acid reaction and consists of pus cells, disintegrated nerve fibres and cells, bacteria and granular detritus. The abscess varies in diameter from one-third of an inch to three inches, and is surrounded by a fibrous wall consisting of an inner layer composed of fatty granular cells, a middle layer of germinal and fibrous tissue and an outer of fatty cells. Abscesses with no such distinct wall may occur; these are more prone to spread than the encapsulated variety. Abscesses near the surface of the brain may produce meningitis by extension. Rupture of an abscess wall may take place, death resulting.

Certain instances of cerebritis do not proceed farther than the stage of *red softening*, the exudate being absorbed and recovery ensuing with the formation of an apoplectic cyst or a cicatrix.

Symptoms. The course of abscess of the brain may be either acute or chronic; in the former type the disease runs its course within a few days. The symptoms are those of increased intracranial pressure, such as headache, dizziness, vomiting and mental hebetude or delirium, followed by coma. Epileptiform convulsions may occur but are rather infrequent; the pupils may be unequal. Toxic symptoms are superadded to those of pressure and are those usually seen in septic conditions, such as an irregular temperature curve, usually not every high, sometimes subnormal, chills, prostration and emaciation. The pulse is usually slow—from 60 to 70. Symptoms of local irritation, such as paralyses or aphasia, are not infrequent; symptoms referable to the cranial nerves, except the optic—optic atrophy not being uncommon—are rare.

The symptoms of the chronic type are the same as those discussed above but they develop much more slowly. Even after the abscess has been formed there may be remissions during which the symptoms remain latent although headache, irritability, dizziness and mild convulsions may persist. The periods of remission may be interspersed with exacerbations of the symptoms. After months of such alternation the terminal period begins; here the symptoms are those of the acute type of rapid course and are quickly followed by death in coma. This rapid termination is due to rupture of the abscess or hæmorrhage into it. Instances of abscess of the frontal lobe have gone to autopsy without the lesion having been suspected.

Complications such as phlebitis of the superior petrosal and lateral sinuses are frequent in abscess due to middle ear disease; meningitis is more likely to complicate instances due to trauma. In the former the symptoms of the complication are œdema of the tissues about the ear and of the neck, with hardness

of the jugular veins; meningitis is evidenced by stiffness of the neck and cranial nerve involvement.

The prognosis is uniformly bad unless the seat of the disease can be reached by surgical means.

Treatment. Prophylaxis consists in the proper management of nasal and aural lesions and attention to the cleanliness of all cranial injuries. Further than this the treatment is purely surgical and consists in trephining the skull and evacuating the abscess. For the technique of this procedure the reader is referred to works upon surgery.

TUMORS OF THE BRAIN AND ITS MEMBRANES.

Among the neoplasms affecting the brain alone are classed also all tumors within the cranium and those external to the cranial cavity which subsequently, by extension, affect the brain, such as those of the orbit, of the nasal cavity and of the neighboring fossæ.

Varieties. Of these the most common is the tuberculoma or tuberculous tumor, next in order of frequency is the glioma and following these in order of frequency are the sarcomata, carcinomata, cystic tumors, including those due to the echinococcus and the cysticercus cellulosæ, and gummata. All the other varieties of neoplasm occur in the brain, such as lipomata, myxomata, fibromata, osteomata, cholesteatomata, psammomata, etc., but those mentioned above are most commonly met. Of these only gliomata and psammomata occur nowhere but in nerve tissue.

Ætiology. Brain tumors seem to be more common in the male sex and are seen at all ages. Tuberculous tumor is more frequent in children, while late in life carcinoma is the usual type of neoplasm. During adolescence and early adult life we meet gummata, sarcomata, gliomata and parasitic tumors. Metastatic tumors are rare and are chiefly carcinomata. In the production of new growths of the brain heredity has little influence. As an exciting cause trauma may occasionally be a factor.

The portions of the brain most frequently involved are the base of the cerebrum and the cerebellum (tuberculoma); the hemispheres and pons (gumma); the cerebral substance near its surface and the ventricles (cystic tumors), the pineal gland (psammoma). Glioma is seen in the retina spreading to the cerebrum or may develop primarily in this site; sarcoma, carcinoma, myxoma and fibroma affect the meninges; sarcoma, mucous and fibrous tumors occur in the sheaths of the vessels, while carcinoma at times is found in the substance of the hemispheres.

Symptoms. These are chiefly due to pressure and vary with the situation of the tumor. Of general symptoms, one of the earliest and most prominent is headache, usually constant but with intensely severe exacerbations; at

times it may intermit. Vomiting, often without nausea, may accompany the headache or occur independently; it may be of projectile type. Vertigo is frequent and varies in degree; it may be slight or so marked as to interfere with walking or standing.

Mental symptoms such as irritability, loss of memory, absent-mindedness, dulness, drowsiness and, at times, coma, may be present or conditions of excitement or delirium may be manifest.

Speech defects, most commonly a running together of the syllables, may occur.

Epileptiform or apoplectiform attacks (see Jacksonian epilepsy, p. 823) are characteristic symptoms. Choreiform twitchings may be observed. True apoplexy may take place from rupture of a blood-vessel in or near the tumor.

Optic neuritis is one of the most important symptoms from a diagnostic point of view. It occurs in a large majority (80 percent.) of patients, its course is progressive and it terminates in optic atrophy; it is usually bilateral but the nerve of one side may be involved before that of the other. Choked disc is not infrequent.

Sensory disorders such as pruritus, derangements of tactile sensation and neuralgic pains, as well as disturbances of the special senses, may occur.

Urinary abnormalities (polyuria or glycosuria) may be observed if the tumor involves the floor of the fourth ventricle.

As the disease goes on the appetite and the nutrition suffer, though more rarely these manifestations are absent, and as the patient nears death the pulse may become slow, the breathing irregular and the temperature elevated.

The observance of symptoms referable to the situation of the neoplasm is important particularly from a standpoint of diagnosis. In order to systematize the different symptoms which may occur as a result of tumor occurring in different localizations, the brain has been divided (Dana) as in Fig. 11.

a. The prefrontal area may be considered as that portion of the brain anterior to a line drawn at right angles to another drawn through the frontal and occipital extremities of the brain and beginning at the upper end of the ascending branch of the Sylvian fissure.

b. The central region includes that portion of the cerebrum between the line described above and another, limiting the posterior central convolution prolonged downward to the fissure of Sylvius.

c. The parietal lobe.

d. The occipital lobe.

e. The temporal or temporosphenoidal area.

f. The pons and medulla.

g. The cerebellum.

Other situations not included below are:

h. The corpus callosum.

i. The basal ganglia and capsules.

j. The corpora quadrigemina and pineal gland.

k. The crura cerebri.

l. The base of the cerebrum.

Tumors situated in the prefrontal area may cause no localizing symptoms, particularly if on the right side, and even general symptoms may be lacking. In other instances the latter may be plainly evident, emotional disturbances,

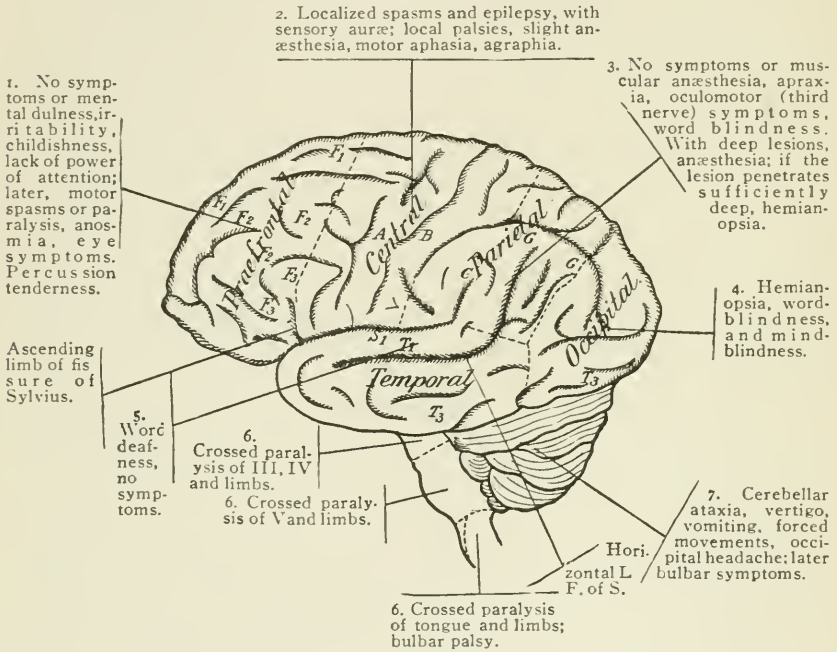

FIG. 11.—Showing focal symptoms of brain tumor—(*after Dana*).

mental stupidity and irritability being present in affections of either hemisphere. Aphasia may occur if the lesion involves the inferior frontal convolution and spasm or destructive paralysis may result if the tumor extends posteriorly. Hemianopsia and optic neuritis may be caused by involvement of the optic tract; disturbance of the sense of smell by involvement of the olfactory centers. Invasion of the orbit results in oculomotor palsy and exophthalmos. There may be tenderness on percussion over the neoplasm.

Tumors of the central region may cause spastic symptoms. If in the upper part of this region spasm of the toes, ankles or legs; if in the middle third the spasm begins in the fingers, forearm or shoulder; if in the anterior third the

facial muscles or tongue are affected. With the spasmodic symptoms there may be numbness or tingling, beginning in a certain group of muscles. Muscular sense may be disturbed.

Tumors of the parietal lobe may be accompanied by no symptoms but stereagnostic perception may be affected; word and mind blindness may be associated with involvement of the angular gyrus and inferior parietal lobule. Third nerve paralysis has been observed in tumors near the angular gyrus, though this symptom is difficult of explanation.

If the tumor extends to the central region motor symptoms may occur.

Tumors of the occipital lobe involving the cuneus may cause homonymous hemianopsia if unilateral, complete blindness if bilateral. In tumor of other portions of the left lobe mind blindness may result, while if the angular gyrus is involved the hemianopsia may be associated with word blindness. Accompanying extension forward into the parietal lobe there may be hemataxia, hemianæsthesia and possibly partial hemiplegia.

Tumors of the temporosphenoidal lobe may, when in the posterior part of the first and in the posterior superior part of the second gyrus, be evidenced by word deafness; if on the right side they usually are without symptoms. In involvement of the hippocampal convolution there may be disorders of smell and taste.

Tumors of the pons and medulla cause either irritation or destruction of the fibres of these structures or symptoms due to pressure. At times both these consequences result. Neoplasms in this vicinity are likely to produce symptoms involving the face on one side and the body upon the other.

Accompanying lesions of the peduncle of the cerebrum there may be third nerve paralysis on the side of the lesion and hemiplegia of the other side. In lesions below this point and involving the pons, paralysis of the fifth nerve of the same side and hemiplegia of the opposite side may result. Sixth nerve involvement with internal strabismus may be associated with tumors still lower down and also facial palsy and deafness due to involvement of the seventh and eighth nerves may occur. In tumors of large size, hemianæsthesia and forced movements of the body and conjugate deviation of the eyes away from the affected side may be present.

In neoplasms of the medulla there may be hemiplegia; hemianæsthesia and bulbar symptoms may occur. Irritation of the nuclei of the ninth, tenth, eleventh and twelfth nerves, which have their origin in this structure, may also result, being evidenced by dysphagia, irregular cardiac action and respiration, and vomiting. Retraction of the head, numbness, tingling, and even convulsions may be present. Pressure on the cerebellum causes disorded coördination and a staggering gait.

Tumors of the cerebellum are evidenced by very typical symptoms which are described in detail on p. 750.

Tumors of the corpus callosum cause symptoms analogous to those due to involvement of the third and lateral ventricles. There are no symptoms referable to the cranial nerves, but mental hebetude and stupor, hemiplegia of gradual development and finally paraplegia are likely to be present.

Tumors of the basal ganglia and internal capsule cause symptoms resembling those of lesions of the corpus callosum, such as gradually increasing hemiplegia with accompanying hemianæsthesia and, if the tumor involves the optic thalamus and neighboring portions of the internal capsule, athetoid and choreiform movements may be present. Tumors involving the anterior portions of the optic thalamus may also be evidenced by these movements while those of the lenticular or candate nuclei alone are usually without symptoms. If very large, however, tumors of the thalamus may produce hemianopsia or hemianæsthesia, and neuritis of the optic nerve is often an early symptom.

Tumors of the corpora quadrigemina alone are rare, there being usually associated involvement of the crura. They are evidenced by disturbance of coördination, forced movements and oculomotor paralyses, with nystagmus and loss of pupillary reflexes; hemianopsia or complete blindness may also be present. *Tumors of the crura* are rarely met. They may cause oculomotor palsy on the same side, due to third nerve involvement, and hemiplegia of the opposite side.

Tumors of the base of the brain, when in the anterior fossa, are accompanied by symptoms very similar to those caused by tumors of the prefrontal area with the addition of loss of the sense of smell resulting from involvement of the olfactory lobe. Disturbance of the second and third nerves may also be present. Neoplasms of the middle fossa and interpeduncular space press upon the optic chiasm and are consequently accompanied by optic neuritis and bitemporal hemianopsia.

The presence of a tumor may be suspected from the general symptoms, its situation from the focal manifestations. The Röntgen ray has been employed in the diagnosis of the condition and at times has given brilliant results although the failures have been in the majority. Possibly further perfection of this means of diagnosis may produce successes with greater uniformity.

The prognosis. Tumors of the brain due to syphilis may be benefited by medical treatment. Gliomata and fibromata may continue to grow slowly for a number of years and tuberculous neoplasms at times cease increasing in size and undergo calcareous degeneration. Malignant tumors may cause death in a year or two, death either being sudden, due to involvement of the fourth ventricle, or preceded by gradually increasing coma due to progressively augmenting intra-cranial pressure.

Treatment consists in regulating the patient's mode of life within strict

hygienic limitations. The use of alcohol, sexual over-indulgence and all causes of excitement should be avoided since any influence tending to cause cerebral hyperæmia may result fatally. These considerations should be kept in mind in dealing with all varieties of cerebral neoplasm, as well as the fact that the exhibition of general tonic treatment is indicated.

In growths of suspiciously syphilitic character, as well as in all others in which the type of the lesion is uncertain, antisyphilitic treatment should be administered. Cerebral gummata are readily and rapidly absorbed by this means. This treatment may be prescribed in the form of mercurial inunctions and the internal administration of potassium iodide in increasing doses or the syrup of hydriodic acid in doses of 1 drachm (4.0) three times a day. Both the mercury and the iodide should be given to the limit of the patient's tolerance. The mercury may also be given in the form of the bichloride, $\frac{1}{12}$ of a grain (0.005) three times a day or hypodermatically (the salicylate 1 grain—0.065—suspended in benzoinol). When the tumor appears to have ceased increasing in size the mercury may be stopped but the iodide should be continued in sufficient dosage to control the growth.

Tuberculous tumors necessitate the employment of the usual means indicated in tuberculous conditions, such as iron, codliver oil, etc., and here particularly, proper diet, out-door life and attention to the patient's general hygiene should be insisted upon.

For the headache the bromides, antipyrine, antipyrine salicylate (salipyrine) or acetphenetidine (phenacetine) may be employed. The ice cap or the application of leeches is also useful in this connection and if occipital, the pain may be relieved by the application of the actual cautery to the nape.

In the light of the advances which surgery and cerebral localization have made of late years operative procedures may be employed with comparatively slight danger. Success is most likely to be attained in sarcomata and fibromata involving the dura and in neoplasms of the cerebellum. Even if the growth is not found, or proves to be impossible of removal, the operation, since it relieves the intra-cranial pressure, may result in material benefit to the patient.

CEREBELLAR DISEASE.

While the cerebellum may be the seat of disease of considerable extent without symptoms to suggest the lesion, affections of certain portions of this structure, namely its central lobe and vermiform process, are characterized by very typical manifestations.

Tumor is the most common cerebellar lesion, neoplasms of various character, such as sarcoma, tuberculoma, glioma, cystic tumors, gumma, etc., having been observed. Abscess and hæmorrhage may occur but these conditions are very much rarer.

The principal symptoms of cerebellar disease are disordered gait, vertigo and headache.

The gait is uncertain, the patient reels and stumbles to one side or the other, forward or backward, very much after the manner of a drunken man. He is likely to walk with the feet wide apart, for this diminishes the tendency to stagger. Muscular sense remains normal, consequently there is no Romberg symptom. The arms and body are seldom affected.

The vertigo varies in degree, is not constant and may occur independently of the gait disturbance. It is most marked when the patient is standing or walking and is very greatly diminished or absent entirely when he is sitting or lying. If of severe type it is a most distressing symptom.

Headache is frequent; in most patients it is occipital, while less frequently the pain may be in the temporal or frontal regions.

Other symptoms suggestive of cerebellar disease are vomiting, spasmodic movements of the eyes, optic neuritis which may go on to atrophy and blindness, and neuralgic pains at the back of the head and neck. The knee jerks are often exaggerated but may be entirely absent. More rarely effusion into the ventricles resulting from obstruction of the venæ Galeni, symptoms referable to pressure upon the medulla and the origins of the cranial nerves, glycosuria, rigidity of both sides of the body from pressure interference with the paths of the motor nerves and sudden death from involvement of the medullary centers may occur.

Forced positions may accompany lesions of the middle peduncles of the cerebellum. When these are present the patient assumes a position in bed and, when moved, unconsciously reassumes this posture; constant positions of the head and eyes may be associated with this symptom.

Forced movements may be present; these consist of a turning of the body about its longitudinal axis or a tendency to walk in circles.

DISEASES INVOLVING CHIEFLY THE SPINAL CORD OR ITS MEMBRANES.

ACUTE AND CHRONIC MYELITIS.

Definition. An acute inflammation of the spinal cord. Acute myelitis differs from the subacute and chronic forms of the inflammation merely in rapidity of development of symptoms, consequently as far as ætiology and pathology are concerned the different types will be discussed as one. As the inflammation involves different extents of the cord, to it different terms are applied; *transverse myelitis*, when an entire cross section of the cord is affected; *diffuse* when a large extent vertically is diseased; *focal* when but one small area is

involved; *disseminated* when the disease affects a number of small areas; *central* when the gray substance about the central canal is inflamed.

Ætiology. The disease is met at all ages but more frequently in males. It may occur as a result of exposure to the inclemencies of the weather, following injuries, such as contusions, strains or fractures of the spinal column, secondary to sepsis and the infectious diseases, as a result of syphilis or of disease of the vertebræ. Many of these factors cause, first, a mechanical injury which is followed by inflammation as a secondary manifestation.

The most common site of the lesion is the upper dorsal, the most infrequent the lumbar region.

Pathology. The spinal cord is at first intensely congested, reddish-brown in color, softer in consistency than normal, and the distinction between white and red matter is less marked; tiny hæmorrhages may be visible, their sites later becoming cavities; later in the acute type, the color changes to yellowish or white, the affected area is infiltrated with serous fluid and becomes softened and degenerated. The meninges also are the seat of morbid change.

The microscope reveals the presence of extravasated red cells and leucocytes, of the latter, however, but a few; in places the nerve tissue has wholly disappeared, in others degenerated axis-cylinders without medullary sheaths may remain; the ganglion cells may be entirely destroyed or are of rounder outline and without processes. As the nerve tissue is destroyed its place is taken by neuroglia, the cells of which increase in number. Deiter's cells may be present, as also may granular fatty cells, and the walls of the enlarged blood-vessels are the seat of hyaline degeneration. Where the normal cord substance has been replaced by neuroglia tissue, no regeneration is possible, the change being permanent

Symptoms. The onset of myelitis may be sudden with a chill, followed by a rise in temperature, 103°–104° F. (39.5°–40.° C.) or even higher, rapid pulse, headache and prostration, or there may be prodromal symptoms such as numbness or other paræsthesiæ in the back and extremities. More rarely is the disease ushered in by convulsions.

The typical symptoms differ so markedly with the portion of the spinal cord affected that it is considered best to discuss those likely to be met in most cases and later those which are characteristic of the various areas of the cord usually involved.

a. The symptoms of motor irritation. These are seen both at the onset and during the progress of the disease and consist of convulsive movements, either quick or slow, of the muscles of the legs.

b. The symptoms of motor paralysis. These appear early and are the first symptoms to suggest the diagnosis; they consist of a weakness and loss of power in the legs, progressing until total paraplegia is present. If one leg is less affected than the other, the inflammation is less general in the corre-

sponding half of the cord. In lumbar or dorsal myelitis only the lower limbs are paralyzed; in myelitis of the cervical region all four extremities are paralyzed.

c. Sensory disturbances are late symptoms. Early in the course of the disease there is rarely pain, but numbness and tingling of the extremities, and at times the girdle sensation may be present. The sense of touch remains normal except at very late stages of the affection when anæsthesia is the rule, although hyperæsthesia or paræsthesiæ may be present. Sensory disturbances aid us in diagnosticating the level of the lesion since their upper limit corresponds in fair degree to the site of the inflammation.

d. Reflex disturbances. These differ with the site of the lesion and with the extent of cord involved. In lumbar myelitis the skin reflexes are diminished over the legs; in dorsal or cervical myelitis when the lumbar cord is intact, the cutaneous reflexes of the legs may be normal or increased, owing to the fact that the lumbar reflex arc is unaffected and the possibility of interference with the inhibition. At times, however, these reflexes may be diminished even in dorsal or cervical lesions.

The patellar reflex and ankle clonus are absent when the lumbar cord is extensively diseased and the former is lost when the inflammation involves the lateral posterior columns and the anterior horns in this region. When the cord above the lumbar region is affected, the tendon reflexes of the legs are increased owing to the interference with the passage of inhibitory impulses. A lesion involving the entire cord in the dorsal or cervical region may be accompanied by a loss of the reflexes in the lower extremities. When the inflammation is confined to the cervical region, the tendon reflexes of the arms may be exaggerated.

e. Bladder and rectal disturbances. Early in the disease both micturition and defæcation are delayed, later there is retention of urine and ultimately the bladder and rectum become incontinent.

f. Trophic and vaso-motor disturbances. When the lesion is in the dorsal or cervical cord there is no wasting of the paralyzed muscles of the legs, but when the lumbar cord is involved, atrophy takes place and, if the anterior horns or nerve roots of the cervical region are diseased, the same condition occurs in the muscles of the arms. Bed-sores over the buttocks or heels develop as a result of trophic disorders and the skin becomes dry and hard and the nails brittle.

Vaso-motor changes result in mottling of the skin, œdema and hyperidrosis; the surface temperature of the paralyzed limbs is often subnormal.

The electric reaction of the muscles, when these are atrophied, is changed and the reaction of degeneration is present.

Cervical myelitis is characterized by paralysis of greater or less extent in the arms and complete paralysis of the legs; atrophy of all or only certain

groups of the muscles of the arms while the muscles of the legs remain of normal size may be noted; these latter, however, may become flaccid from disuse. The deep reflexes of both sets of limbs, or only of the legs, are exaggerated and vesical and rectal disturbances occur.

In *dorsal myelitis*, while the upper limbs retain their normal state, the legs are paralyzed and may be the seat of sensory disorders. If the anterior cornua are involved there may be muscular atrophy and reaction of degeneration; vesical and rectal disturbances develop and, while the cutaneous reflexes usually remain normal, the knee jerk is increased and ankle clonus is present.

In *lumbar myelitis* the arms are not affected; the legs are paralyzed and atrophied and the reaction of degeneration is observed; rectal and vesical disturbances are present and both cutaneous and deep reflexes are absent.

The prognosis. Rarely instances of very rapid development, causing death in a week or ten days, may occur. The usual course of the disease is chronic after a more or less acute onset and continues for months and often years. The chances for improvement remain good up to about a year and a half after the beginning of the symptoms; they are less favorable when motor disturbances are marked than in instances evidenced chiefly by sensory disorders; they are worst in cervical and best in dorsal lesions. Death may result from exhaustion or concurrent disease.

Treatment. During the acute stage the patient must be kept in bed, the bowels are kept regularly open by means of laxatives and the pain and local congestion may be relieved by the application of leeches or wet or dry cups to the spine. If cardiac excitement or hypertension of the arterial system is present aconite or glyceryl nitrate should be given. After the acute symptoms have subsided, moderate doses—gr. viii to x (0.52–0.66)—of potassium iodide should be administered and if there is the least suspicion of syphilis as a causative factor the patient should be immediately put upon a course of mercurial inunctions and increasing doses of potassium iodide. The tonics, iron, strychnine and quinine are useful as adjuvants. If there is no response to the antisyphilitic treatment, sodium arsenate gr. $\frac{1}{10}$ (0.006) three times a day, elixir of phosphorus 1 drachm (4.0) three times a day or silver nitrate gr. $\frac{1}{4}$ to $\frac{1}{2}$ (0.016–0.032) three times a day may be tried. A necessary precaution in the administration of these drugs is a period of intermission every two to four weeks depending upon the tolerance of the patient. Gold chloride has been recommended but there is doubt if this or any of the other substances mentioned above can materially influence the course of the disease.

Very important considerations are the prevention of cystitis and bed-sores. The disturbances of the bladder may be mitigated by the internal administration of tincture of hyoscyamus 15 to 20 minims (1.0 to 1.33), oleum santali, hexamethylenamine and the various balsams; when catheterization becomes necessary the utmost attention must be given to the asepsis of the procedure.

Bed-sores may be guarded against by means of attention to the cleanliness of the back and limbs and of the bed, by powdering the parts with talcum, tannic acid or lycopodium, by bathing with alcohol and astringent solutions and by the use of the water bed when necessary. In the later stages of the disease it is preferable to empty the bowel by irrigation rather than by purgatives. Electricity in the form of galvanism should be employed, the electrodes being applied to the vertebral column over the seat of the lesion. Both faradism and the continuous current should be administered to the affected nerves and muscles of the limbs and electric treatment of the bladder may accomplish good. Massage is an excellent means of exercising the paralyzed muscles and preventing wasting, it also improves the circulation and the general condition of the patient.

Hydrotherapeutic measures should be employed with care, and while benefit may attend the use of warm (85°–90° F.—29.5°–32.5° C.) full baths or cooler (75°–80° F.—24°–27° C.) half baths, both with thorough frictions, cold baths and applications are not advisable. The baths may be more stimulating if salt is added and sojourns at the various hot springs of this country or Europe, when the patient is able to travel, are often beneficial.

In the chronic stage of the disease mechanical appliances or tenotomy, employed with a view to straightening the contracted limbs, may be advised. Compression myelitis should be treated with proper orthopædic apparatus with the object of relieving the pressure upon the cord and, when the lesion is the result of vertebral fracture, such surgical operations as laminectomy, etc., may be indicated.

The diet of the patient should be sustaining and easily digestible and assimilable, and he should lead a quiet restful life, as much in the open air as his condition and the weather permit. Sea voyages, when possible, are especially to be recommended.

MYELOMALACIA.

This is a condition of the spinal cord resulting from an insufficient blood supply due to embolism or thrombosis of its nutrient blood-vessels and characterized by a degeneration of the cord substance. The initial change consists in a necrosis accompanied by the extravasation of red blood cells and leucocytes; upon microscopical examination degenerated nerve fibres and fatty cells may be seen together with red and white blood discs; later the degenerative nerve substance is replaced by neuroglia tissue.

ACUTE ANTERIOR POLIOMYELITIS.

Synonyms. Infantile Spinal Paralysis; Infantile Palsy; Acute Atrophic Paralysis.

Definition. An acute febrile disease characterized by paralysis of rapid

development, followed by wasting of the muscles and without disturbance of sensation.

Ætiology. This disease occurs, in by far the majority of instances, in infancy and childhood. It may be met at all ages but is rare after the age of ten years. It appears most commonly in the warm months—June to September—and a number of epidemics have been reported. Over-exertion and chilling of the body may be contributory causes and the condition may appear as a sequeia of the infectious diseases, especially measles, typhoid fever and diphtheria. The specific cause of anterior poliomyelitis is probably an infectious bacterium.

Pathology. The disease is one of the anterior horns of the spinal cord, particularly in the region of the cervical and lumbar enlargements. It is characterized by an acute exudative inflammation, and consequent degeneration with replacement by connective tissue, of certain groups of cells. As a result of this process there occur an atrophy of one or both cornua, slight sclerotic changes in the lateral columns, atrophy of the anterior nerve roots and of the muscles which they supply.

Symptoms. The onset of the disease is usually sudden, although such prodromal symptoms as slight malaise and rise of temperature are sometimes observed. The sudden onset is characterized by a moderate but rapid rise in temperature—101° to 102.5° F. (38.5°–39.2° C.), rarely as high as 105° F. (40.5° C.)—headache, pains in the back, limbs and joints, vomiting and, perhaps, stupor. Slight convulsions may occur, but are rare, as is delirium or coma. The paralysis may set in at once or not until the constitutional symptoms, which seldom last longer than two or three days, have abated.

This involves both legs equally in the majority of patients, next in frequency one leg, next an arm and a leg. Various other combinations may occur but are less common than the foregoing. The muscles of the eye, the larynx and those of respiration are unaffected but in adults the facial nerve may be involved. The paralysis reaches its height in from one to four days after the invasion, remains stationary for from two to six weeks and then gradually improves; seldom does it wholly disappear. It usually remains in a certain group of muscles. In the legs the extensor muscles are most commonly involved, in the arm the deltoid. The affected limb atrophies, the atrophy being most marked in the permanently paralyzed muscles. The nutrition of the whole limb suffers and its growth is impaired, the skin temperature is subnormal, the cutaneous sensibility is unaffected, the sphincters of the bladder and rectum remain normal; the reflexes at the level of the lesion are lost, elsewhere they are unchanged.

The reaction of degeneration is present, faradic irritability being lost within a week or two; galvanic irritability persists but is diminished.

Various deformities result, not so much from the paralysis as from the unop-

posed action of the healthy muscles; of these the most frequent are talipes equinus and talipes varus and valgus. The lack of development in the affected leg, when only one is involved, results in tilting of the pelvis and spinal curvatures.

The patient's general health remains unaffected. The prognosis as to life is good but as to final recovery is less favorable. The use of the faradic current is an excellent means of ascertaining which muscles will be permanently affected. After two weeks the muscles in which faradic irritability persists will recover entirely. After three months the muscles in which it has returned will recover to some extent; after six months the muscles which do not react will remain permanently involved.

Treatment. During the acuity of the disease the patient should be kept in bed, at the onset the bowels should be opened by fractional doses of calomel followed by a saline, and diaphoresis should be induced by hot mustard baths or the hot pack. For the febrile movement tincture of aconite, 1 to 2 minims (0.065–0.130) every half to one hour, should be administered; small doses of antipyrine or spiritus ætheris nitrosi, ½ to 1 drachm (2.0–4.0) every four hours may be given. The administration of the salicylates and of ergot has been suggested, the former particularly in patients of rheumatic heredity, but it is doubtful if they or any other drug of which we now have cognizance can influence the progress of the lesion. Counter-irritation to the spine by means of leeches, dry cups, the Paquelin cautery, mustard, iodine or ice bags is indicated, but we should never blister. A weak mustard paste applied at intervals of two hours and sufficiently long to redden the skin is as effectual as anything. The dry cups should be of small size and may be applied to the skin along both sides of the spinal column. The child should be encouraged to lie on its stomach. In the chronic stage, drugs are of little value but nerve and general tonics such as strychnine, phosphorus, iron, arsenic and codliver oil, may be prescribed. At the end of two or three weeks the use of electricity may be cautiously instituted, first applying the electrodes without the current in order to gain the little patient's confidence. The galvanic current should be used on the paralyzed muscles, the faradic on those unaffected. Treatment by this means may be given two or three times a week for the first month or so and for the following four weeks, daily, each limb receiving the current for two or three minutes only; after an intermission of two or three weeks another month's treatment should be started and so on at intervals until a year has elapsed. After this little benefit will be obtained in most instances, but rarely those occur in which electricity may produce good results even later in the disease. It must be remembered that electricity should never be used until after the acute stage has passed, and then never for a sufficiently long time to tire the muscles. In lessening the tendency to muscular wasting, systematic massage and frictions, given for from five to ten minutes daily to each affected limb, are even

more important than electricity. The patient should be dressed warmly and the paralyzed limb especially, should be kept warm and to this end may be wrapped in cotton at night or surrounded by hot water bags. An excellent idea is to allow the child to play in a full bath of salt water at 98°–99° F. (36.9°–37.4° C.) for a half hour each day.

Exercise and life in the open air should be advised and the moderate use of light gymnastic apparatus may, in proper patients, be encouraged.

Contractures and deformities may be prevented by the application of splints, braces and other orthopædic appliances, and may be radically corrected oftentimes by surgical intervention, tenotomies, tendon transplantations and the like.

CHRONIC ANTERIOR POLIOMYELITIS.

Synonym. Progressive Spinal Muscular Atrophy.

This is a rare disease, is most often seen in adult males, and, while its direct causation is unknown, exposure to cold and wet, chronic plumbism and syphilis, are thought to contribute to its incidence.

Pathology. The morbid anatomy of this condition consists in an atrophy of the fibres and cells of the anterior cornua of the cord. There is no acute inflammation, but merely wasting of the involved nerve tissues; the anterior lateral columns and the anterior nerve roots are also affected and the degenerative process extends both along these tracts and also down the motor nerve fibres even to their termination in the muscles; these latter, too, are involved in turn, their striæ becoming indistinct and fatty degeneration developing.

Symptoms. These vary with the portion of the cord diseased. There is usually a gradually increasing paralysis of the extremities, one or all, followed by atrophy and wasting; the reaction of degeneration is present, the bladder and rectum are undisturbed; the reflexes in the affected muscles are lost; the circulation of the affected limbs is poor and the skin cold. There is no acute stage of onset. The disease steadily progresses with greater or less rapidity and death ensues within a few months or the course of the affection may be prolonged for a year or two.

Treatment. This is practically identical with that of the chronic stage of acute anterior poliomyelitis. Rest is essential, massage and electricity should be employed, a course of mercury and potassium should be instituted and strychnine and arsenic in moderate dosage may cause some improvement. Attention should be given to the general hygiene of the patient in the way of nourishing food, plenty of fresh air, etc.

LATERAL SCLEROSIS.

Synonyms. Spastic Spinal Paralysis; Spastic Paraplegia; Spasmodic Tabes Dorsalis.

Definition. A chronic sclerosing inflammation of the lateral pyramidal tracts of the spinal cord.

Ætiology. This is a disease of adult life, although it has been observed in children; heredity seems to exert an influence in some cases. The condition seems sometimes to occur as a result of syphilis, trauma, exposure, excessive muscular exertion, chronic plumbism and the infectious diseases. The so-called Little's disease is akin to lateral sclerosis, but is a congenital affection and the result of a lack of development of the lateral tracts or due to premature or instrumental delivery.

Pathology. The sclerotic change in the lateral pyramidal tracts usually begins in the lumbar cord and involves the crossed pyramidal tracts as well. The degeneration extends upward and the myelin is gradually replaced by connective tissue. Other lesions such as myelitis, meningomyelitis and multiple sclerosis often co-exist and, when the process reaches the cervical cord, the anterior median columns may be affected.

Symptoms. The patient's attention is first called to the existence of this disease by a feeling of fatigue in the legs, this progressively increases until walking becomes difficult owing to the increased spasticity and paralysis. The gait is characteristically "spastic," that is, the toes drag, the knees are but little flexed and overlap one another, the feet are hardly lifted and the motion is stiff. Contraction of the muscles of the calf may compel the patient to walk on his toes. Motor paresis is a characteristic symptom but at times is absent, yet the spastic condition is sufficient to disorder the gait, even though the patient may be able to walk considerable distances. In marked degrees of paresis the muscles are firm and tense and the legs are held permanently extended, the feet being in a position of plantar flexion. Sudden attempts to flex the knees or the feet upon the legs are resisted but, if force is exerted gradually, the effort will be successful. The patellar reflex is markedly exaggerated, ankle clonus and the Babinski reflex (upturning of the toes, especially the great, when the sole is stroked) are present. The reaction of degeneration is absent, the bladder and rectal functions are normal, there are no sensory disorders nor does atrophy appear until late in the disease. The disease progresses but slowly, the patient, in the later stages being unable to walk or stand. The muscles of the arms are seldom affected, but when this does occur, the extensors are first and chiefly involved, the paresis and exaggeration of the tendon reflexes being analogous to that found in the lower extremities.

Hysteria may exactly reproduce the symptoms above described (hysteric spastic paraplegia) but the differential diagnosis, while not easy, may be made upon finding other hysterical manifestations.

The prognosis. The progress of this disease is slow and prolonged and recovery is not to be expected. The general health and the mind are not disturbed.

Treatment. If syphilis is suspected the patient should be put upon mercurial inunctions and potassium iodide; the spastic condition of the limbs may be lessened in certain cases by conium extract, gr. ½ to 1 (0.032–0.065), the bromides or hydrated chloral; the latter drug, however, should be given with the greatest caution lest the habit become established. Galvanism and faradism may be employed and while they are likely to accomplish little in the ordinary type of the disease, in hysterical spastic paraplegia they are very useful on account of the impression made upon the patient. Massage and passive movements, when not too vigorous, may lessen the spasticity and the patient should be encouraged to do a moderate amount of walking so as to keep the legs as limber as possible. Warm baths lasting from twenty to forty minutes at a temperature of 92°–98° F. (33.3°–36.7° C.), during which passive movements are practiced, are often of benefit.

Braces and other appliances are useful in special instances and tenotomies may become necessary in order to straighten the limbs.

AMYOTROPHIC LATERAL SCLEROSIS.

Synonym. Charcot's Disease.

Definition. A chronic disease characterized by degeneration of the lateral columns of the spinal cord, associated with atrophy of the motor cells in the anterior horns and medulla, and a consequent progressive atrophy of the muscles.

Ætiology. This disease is most frequently met in males from twenty-five to fifty years of age. Its actual cause is unknown but it is probably the result of an imperfectly developed nervous system. Contributory causes are said to be exposure, over-exertion, the abuse of alcohol, chronic metallic poisoning and injury.

Pathology. The essential lesions are a sclerotic degeneration of the crossed pyramidal tracts of the lateral columns, a like change in the anterior median columns of the spinal cord and an atrophy of the motor cells in the anterior horns; the changes are most frequently found in the cervical cord but may, in old cases, involve the lumbar region as well. The sclerosis in the motor columns may extend to the motor cells of the cerebrum, through the medulla, pons, crura cerebri, capsule and corona radiata, involving on its way the cranial nerve nuclei in the floor of the fourth ventricle. The sclerosis consists, first, of a wasting of the normal nervous substance and secondly in a replacement by connective tissue.

Symptoms. These depend upon the portion of the nervous system first affected by the disease. When the disorder begins in the cervical cord and the anterior horn cells, the muscles of the arms become stiff and their reflex irritability is exaggerated, this is accompanied by a certain amount of paresis,

followed by atrophy of the muscles of the hands, the extensors being involved before the flexors; as the paresis extends further up the arm the atrophy also progresses and is especially marked in the deltoid. Fibrillary contractions appear early, and the fingers are often held in a position of mid-flexion, and the muscles being rigid, it may be difficult for the observer to straighten them.

The symptoms later involve the legs, but in rare cases the lower limbs may be first affected. The symptoms referable to these extremities are fatigue, a stiff gait, difficulty in rising from a sitting posture, tremor, paresis and atrophy; one limb, either upper or lower, may be much more seriously affected than the others.

The electric excitability of the muscles is diminished and the reaction of degeneration may be present. The knee jerk is exaggerated, and ankle clonus and the Babinski symptom are frequently to be obtained. Sensation remains unaffected and there is no disturbance of bladder or rectum except that, in lumbar involvement, there may be nocturnal incontinence of urine. The sexual power may be lost.

Late in the course of the disease bulbar symptoms may appear, speech becoming disordered, swallowing difficult and there may be dripping of the saliva. Atrophy of the tongue and lips may occur and, the patient being unable to properly masticate and swallow his food, nutrition becomes impaired. The pupils may be unequal and while there is usually no loss of mental power, dementia of mild type may develop.

The prognosis is not favorable, although the patient's life may be prolonged and much may be done to make him comfortable. Death occurs from exhaustion, intercurrent disease and not seldom from foreign body pneumonia due to the disturbance of swallowing.

Treatment should be carried out along the same lines as in lateral sclerosis. Feeding by means of the stomach or nasal tube may be necessary if advanced bulbar symptoms are present.

LOCOMOTOR ATAXIA.

Synonyms. Tabes Dorsalis; Posterior Spinal Sclerosis; Duchenne's Disease.

Definition. A chronic disease of the posterior columns and nerve roots of the spinal cord, characterized by sensory and trophic symptoms and disturbances of coördination.

Ætiology. This affection is most often seen in middle life but may occur as early as the tenth or as late as the sixty-fifth year. Heredity is a negligible factor save as regards inherited syphilis. Exposure, excessive exertion, both physical and mental, and sexual excesses have been considered to have a place in the causation of locomotor ataxia, but the most important factor in its

ætiology is syphilitic disease. Various observers state that syphilis is an element in the causation of from 60 to 90 percent. of all cases. It seldom occurs within five years of the primary lesion and often not until a much later period; it seems to appear more frequently in individuals whose secondary period has been characterized by mild symptoms. The disease seems to be rather a result of luetic infection than a syphilitic affection of the spinal cord.

Pathology. On microscopical inspection the cord is found to be diminished in calibre and the posterior columns may be noticeable as a grayish band; the pia mater is usually thickened and less transparent than normal and its vessels are sclerosed. Section of the cord reveals an atrophy of the posterior columns and of the posterior nerve roots. Microscopically the posterior columns are seen to be the seat of sclerosis, their normal structure having been replaced by connective tissue. The same condition obtains in the posterior nerve roots, a degenerative neuritis may involve the sensory fibres of the larger nerve trunks and the finer sensory nerves may contain degenerated fibres. The process usually begins in the lateral zone of the column of Burdach and in the column of Lissauer at about the level of the second and third lumbar segments, thence it spreads through the middle zone of Burdach's column to the column of Goll and finally to the posterior zone of the column of Burdach. The disease at the same time is extending upward, and although the process may take years, eventually the entire area of the posterior columns is involved, together with the posterior nerve roots, the posterior horns of the cord and the medullated fibres of Clarke's column. Ultimately there may be changes in the brain itself.

Symptoms. These are best classified according to the time of their incidence, the disease developing in three more or less distinct stages.

a. The Stage of Pain. Most of the symptoms of this stage are sensory. There are various paræsthesiæ, such as numbness and tingling of the feet, a sensation as if cotton were being trodden upon, sensations of burning or of cold and pruritus over various areas, notably the scrotum and at the anus. Pain is an early and prominent symptom and may continue throughout the course of the disease. It usually begins in the thighs or lower legs and extends as the disease progresses. In certain cases it may be slight or wholly absent, particularly when the onset of the disease is characterized by optic nerve atrophy. The pain is sharp, lightning-like, lancinating, cutting or boring in character, often beginning on the outside and anterior surface of the thigh and later extending to the feet; it usually appears in repeated paroxysms lasting from a second or two to half a minute, or it may occur in attacks lasting, without remission, for hours or days. There is no tenderness. There may be aching pain in the back and loins, or girdle sensations about the legs, ascending to the body as the disease involves higher levels of the cord. The patellar reflex is lost (Westphal's symptom); spinal myosis (contracted pupil)

may be present; the pupil reacts in accommodation but not to light (Argyll-Robertson pupil); intermittent oscellation of the iris due to the influence of light may be seen (Gowers' sign); the bladder control may be partly lost; complete incontinence may finally result. Sexual impotence is not rare.

b. The Stage of Ataxia. The symptoms of the first stage persist and in addition disturbances of sensation appear. Pain sense is lessened and delayed, a pin prick may not be felt until after a perceptible interval, or hyperalgesiæ may be present, pain being caused by even the touch of a finger. Anæsthesia of the popliteal space may occur (Bechterew's sign). The temperature sense is disturbed, the patient becoming very susceptible to cold, while heat is felt less than normal; ultimately the limbs become wholly anæsthetic.

The muscular sense is impaired, the position of the body in space is not correctly perceived and the patient consequently walks unsteadily, especially in the dark when sight is unable to assist the muscular sense, and is unable to accurately touch objects when his eyes are shut; for instance he has difficulty in placing his finger upon the tip of his nose when blindfolded; finer movements of the hands and fingers are performed inaccurately; difficulty is experienced in picking up small objects, in buttoning the clothes and in writing. The gait is characteristically ataxic, the patient walks with the legs widely separated and the body poorly balanced, he lifts the feet too high and plants them too forcibly, bringing down the heel with a stamp; his steps are irregular in length, he staggers and cannot walk in a straight line, especially if the eyes are closed. When the feet are placed closely together and the patient stands with eyes closed, he reels and may fall (Romberg's symptom). There is diminished tonicity of the hip muscles (Fränkel's sign).

Various ophthalmic disturbances may occur, such as optic nerve atrophy, with resulting blindness, ocular nerve paralyses with consequent ptosis and strabismus convergent with contracted pupil when the sixth nerve is affected, divergent with dilated pupil with involvement of the third; the pupil may be oval or irregular (Berger's sign); unilateral deafness, due to auditory nerve atrophy, may develop. The other cranial nerves may be affected.

During this stage the so-called "crises" may appear. These are probably due to a complicating pneumogastric neuritis and are of various types. The gastric crisis is the most frequent and is characterized by sudden severe pain and vomiting which may persist for several hours or even a day or two; intestinal and rectal crises are associated with pain, diarrhœal tenesmus or a sensation of a foreign body in the rectum; laryngeal crises are characterized by sudden cough, stridor, glottic spasm and dyspnœa; cardiac crises resembling attacks of angina pectoris, and vaginal crises, characterized by pain and copious mucous discharge, have also been observed. Trophic disorders, evidenced by the so-called "Charcot joint," an affection probably having its origin in a traumatism which is disregarded by the patient because of disturbance of his

pain sense, and which is characterized by entire absence of pain, great swelling and copious effusion, occur. The knee is most frequently affected but the condition may involve the ankle, elbow or wrist. The ligaments, cartilage and bone are gradually destroyed and spontaneous fracture or dislocation may result. Perforating ulcer of the foot, resulting from a neglected injury often of slight character, may occur. Other trophic disturbances are rarefaction of the bones, with resulting fractures, irregular atrophy of muscles and various skin eruptions.

c. The Stage of Paralysis. The ataxia gradually increases until the patient becomes helpless; the bladder and rectum are incontinent and bed-sores are apt to develop; cystitis with consequent pyelitis may result from the use of the catheter; the patient is confined to his bed, even though his general nutrition remains good.

The prognosis. The course of the disease is chronic and may extend over twenty or thirty years. The first stage lasts from a few months to fifteen or twenty years, the second may develop slowly or rapidly and the third stage is soon terminated by death. The prognosis should always be guarded; it is believed that recovery has never taken place but the progress of the disease may be stopped or at least delayed. The thoroughness with which syphilitic disease of late years has been treated seems to have borne fruit in that mild types of locomotor ataxia are becoming more frequent.

Treatment. In all cases in which there is suspicion of syphilis, appropriate treatment in the form of mercurial inunctions—one drachm (4.0) of the ointment should be thoroughly rubbed into the inner aspect of the thigh or arm daily until the gums become sore, when mercury bichloride may be substituted—gr. $\frac{1}{20}$ (0.003) three times a day—and the internal administration of potassium iodide in ascending doses should be begun. The dosage of the latter must be governed by its effect, as much as possible being given without inducing iodism; after the limit is reached the doses should be diminished by about one-half and continued for several months. If the primary specific lesion is not of recent date certain authorities are inclined to omit the mercury and depend chiefly upon the potassium iodide, others consider the use of the former drug to be contraindicated in cases with optic nerve atrophy on the ground that it may hasten the process. Mercury biniodide may at times be employed with good effect in doses of gr. $\frac{1}{20}$ (0.003) three times a day and a change of the potassium iodide to the strontium salt (gr. xx to xxx—1.33–2.0—three times a day) or to the syrup of hydriodic acid, 1 drachm (4.0) at the same intervals, may prove beneficial.

The disadvantages of antisyphilitic treatment are that it may cause digestive disturbances which result in an impairment of nutrition and that excessive administration of mercury may produce distressing neurasthenic conditions. When after thorough trial it is certain that no benefit from this form of treat-

ment is to be expected it should be stopped; if it acts favorably it should be continued, the mercury being alternated with the iodide, a period of three months being devoted to each, or the two should be given simultaneously for three months, omitted for a like period, then repeated and so forth.

Various other drugs have been from time to time exploited as efficacious in locomotor ataxia; of these those most likely to be affective are arsenic, in the form of Fowler's solution ♏ v (0.33), arsenic trioxide, gr. $\frac{1}{30}$ to $\frac{1}{20}$ (0.002–0.003) or sodium arsenate, gr. $\frac{1}{30}$ to $\frac{1}{10}$ (0.002–0.006) three times a day, aluminum chloride gr. iii to x (0.2–0.66) three times a day, strychnine, gr. $\frac{1}{30}$ (0.002) or less thrice or four times daily, calcium glycerophosphate, gr. iii to v (0.2–0.33) and calcium hypophosphite, gr. x to xxx (0.66–2.0). Silver has been advocated but it, barium, gold, ergot and physostigma are probably of no effect and are little used.

Much can be done in this disease toward mitigating the symptoms; the pains may be controlled by the coal tar analgesics, antipyrine, acetanilide, acetphenetidine, salophen, salipyrine, or aspirin in the usual doses; this symptom at times may yield to a drachm (4.0) of sodium bicarbonate; codeine, gr. $\frac{1}{4}$ to $\frac{1}{2}$ (0.016–0.032) may prove effectual, as also may extract of cannabis indica (gr. $\frac{1}{4}$ to $\frac{1}{2}$ (0.016–0.032) or cocaine, hypodermatically, gr. $\frac{1}{8}$ to $\frac{1}{4}$ (0.011–0.016). The Paquelin cautery applied once or twice a week is a useful agent in the severe pains; cups, leeches and blisters may also be employed with good effect. Morphine in the severe pain may become necessary, it should be given under the skin and only after all other means have failed, on account of the danger of establishing the habit. The insomnia may be relieved by the bromides, veronal, gr. x to xv (0.66–1.0), sulphonethylmethane in the same doses or sulphonmethane, gr. xx (1.33). Hydrated chloral may in extreme instances be combined with the bromides.

The bladder disturbances may be rendered less distressing by the administration of hyoscyamus combined with the balsams, and small doses of strychnine, gr. $\frac{1}{100}$ (0.0006), may be given if sexual weakness is present. Neuralgic pains in the rectum often disappear after an enema and a thorough evacuation. Suppositories containing iodoform, codeine and belladonna may be efficacious.

In the crises a hypodermatic injection of morphine is often the only therapeutic measure which will relieve the patient.

From the beginning of the treatment the physician should insist upon the importance of systematic rest. It may be advisable to put the patient to bed for a number of weeks. If so drastic a measure is not necessary a regular life should be prescribed, with moderate exercise and avoidance of all mental and physical labor. The excessive use of alcohol and tobacco must be forbidden as well as more than moderate venery. Institution treatment for a number of months each year is often of great benefit.

Electricity is useful for its tonic effect upon the muscular and nervous systems and if employed perseveringly may benefit the lesion itself. Galvanism (15 to 30 milliamperes) may be administered by applying the anode to the side of the neck and moving the kathode up and down the spine and limbs. Both the constant and the interrupted currents may be employed in this manner; the former may be effective in the pains and the latter is indicated in vesical weakness.

Hydrotherapeutic measures are often beneficial but have disadvantages, in that the patient often fails to react after the cool bath and the warm bath is likely to prove enervating. Oftentimes, however, a daily lukewarm bath lasting for fifteen or twenty minutes, after which a cool douche is applied to the spine and the patient is vigorously rubbed, is an excellent procedure. Wet compresses to the limbs are often useful to ease the pains and douches neither hot nor cold often affect the patient favorably. Spa treatment with systematic bathing may confer benefit but probably rather from the regular life led at such resorts than from any effect of the bathing itself.

Treatment by suspension was much advocated a number of years ago. The patient was harnessed about the neck and shoulders with a specially constructed apparatus and was by this means lifted from the floor. This was done for a minute or two, two or three times a week for eight or ten weeks, and after an interval of several months, the procedure was repeated. This method seemed to benefit some cases but is little employed at present. It is useless in the stage of paralysis. Treatment by means of education of the muscular sense (the method of Frænkel) is often valuable. This consists of systematic exercises calculated to educate certain nerve fibres of the cord so that they may be able to perform the function of those which have been destroyed. The idea is to train the patient in certain motions requiring coördination. The exercises may be greatly varied, among those applicable are to require the patient to walk a straight line drawn upon the floor, to draw sets of parallel lines with one hand, then with the other, etc. For an extended list the reader is referred to Dana's Textbook of Nervous Diseases. This method, while it does not influence the lesion, often enables the patient to use his limbs to better advantage and is particularly effective in patients in the latter part of the first or early in the second stage.

There is no special diet to be prescribed. The patient should eat regularly a sufficient quantity of nourishing and easily digestible and assimilible food. Fats, starches and proteids are all allowable.

Patients should be encouraged to use every means to combat their disease and to carry out a systematic treatment. Those who have the courage and energy to do this will, after a time, reap the benefit of their perseverance and reach a condition in which they may lead comparatively comfortable lives.

FRIEDREICH'S ATAXIA.

Synonyms. Hereditary Ataxia; Hereditary Ataxic Paraplegia; Family Ataxic Paraplegia; Friedreich's Disease.

Definition. A chronic disease of the spinal cord, occurring hereditarily and characterized by ataxia and paraplegia.

Ætiology. The direct causative factor of this disease is unknown. It seems to occur rather more frequently in males than in females; it may occur in infancy but the greater number of cases develop between the ages of three and fifteen years. It very rarely appears after the age of twenty-five. The condition is probably due to lack of, or to poor development of certain tracts in the spinal cord. It sometimes follows an acute infectious disease, and alcoholism, syphilis and the neurotic tendency in the parents, seem in some measure to be predisposing factors.

Pathology. The lesions of Friedreich's disease are found in the posterior and lateral columns of the cord and consist of a degeneration involving these tracts and at times also the columns of Clarke and Gowers. On examination the cord is found to be smaller than normal and the pia, over the posterior columns especially, is thickened. The normal tissue is seen to be degenerated and to some extent replaced by neuroglia, the cells in the anterior and posterior cornua are atrophied and this change affects also the anterior and posterior nerve roots.

Symptoms. These are, as would be expected, a combination of those of lateral sclerosis and locomotor ataxia—paraplegia with ataxia. Pains at the onset are infrequent, the first symptom noticed being a gradual loss of coördination first affecting the legs. The patient totters and with difficulty maintains his equilibrium, he sways in walking and may fall. Romberg's symptom may be present; the patellar reflex is usually absent, but rarely may be exaggerated. The ataxia of the arms is characterized by choreic and irregular movements; in grasping objects there seems to be an excess of movement. As the disease progresses the jerky movements involve the head and there may be accompanying tremor, nystagmus is present when the eyeballs are moved but is absent when they are at rest. The pupils are usually normal and optic atrophy is very rare. Scanning speech with elision of syllables may occur late in the disease.

The paresis appears later than the ataxia and chiefly affects the legs; the power of the muscles, the flexors more than the extensors, is impaired and consequent talipes may occur; if the muscles of the body are affected, curvatures of the spine result. The nutrition of the muscles is little if at all impaired.

There is a lack of sensory symptoms except, at times, cramp-like muscular contractions in the earlier stages which may cause discomfort. Rarely there

are disorders of the pain and temperature senses and sensation may be slightly delayed.

The mind is not materially affected, but children in whom the disease appears early in life, seldom attain normal development in this regard.

The prognosis as regards recovery is utterly unfavorable but the progress of the affection is slow and may be interrupted by periods of remission; patients who are attacked in the earlier years of life seldom survive to attain maturity.

Treatment is of little avail. With regard to prophylaxis, we should, when the disease has occurred in one member of a family, endeavor to impress upon the parents the necessity of especial care in the feeding and general management of the others. Breast-feeding should be insisted upon, all infections and traumatisms guarded against and excessive physical exertion avoided. Patients affected with the disease should receive nourishing and easily-digestible food and live in as hygienic a manner as possible. Nerve tonics may be employed and may be of some benefit, suspension may be tried and has seemed to act favorably in certain cases. The therapeutic means applicable to locomotor ataxia are worthy of trial. Tendency to contractures and deformity may be combated by orthopædic methods and apparatus.

HEREDITARY CEREBELLAR ATAXIA.

This is a condition characterized by all of the symptoms of Friedreich's disease with the exceptions that in the former affection there are various ocular disturbances such as atrophy and paralyses, together with an increased patellar reflex. The condition usually appears after the age of twenty and is the result of congenital defect in or incomplete development of the cerebellum.

Recent research seems to tend to draw cerebellar ataxia and ataxic paraplegia more closely together as regards lesions and symptoms and it is quite possible that they will come to be regarded as types of the same disease.

Like Friedreich's ataxia, this disease is progressive and with regard to treatment one can hardly do more than maintain the patient's nutrition. Otherwise the affection may be managed in a manner identical with that described under the treatment of the former condition.

BULBAR PARALYSIS.

Synonym. Glosso-labio-laryngeal Paralysis.

Definition. A progressive paralysis involving the tongue, lips, throat and larynx and in advanced instances the muscles of the lower part of the face.

Ætiology. This disease occurs most frequently in middle age. Syphilis,

exposure, and mental and physical over-work have been considered possible causative factors but the direct ætiology of the condition is unknown.

Pathology. The morbid change which characterizes this disease consists in a degeneration of the nuclei of origin of the motor nerves which supply the lips, tongue, throat and larynx. In certain cases the lesion spreads to the cranial nerve nuclei on the floor of the fourth ventricle of the medulla involving the vagus, the fifth in its motor fibres, the seventh, the ninth, the twelfth, and exceptionally the abducens and motor-oculi. The degenerative change is characterized by a wasting of the normal nerve tissue and a replacement of it by neuroglia, with connective tissue increase in the walls of the blood-vessels.

Symptoms. These usually begin with disturbance of the speech; there is difficulty in articulating the linguals, R, L, D, T, the voice is nasal in quality, the tongue becomes atrophied and paralyzed; swallowing is difficult and mastication imperfect. When the muscles of the lips become involved the articulation of the labials, B, F, P, V, becomes imperfect and the lips are thin and tremulous, the facial expression is changed and the saliva dribbles. With involvement of the pharynx and larynx, swallowing becomes impossible, food may be regurgitated, or drop into the larynx and cause foreign body pneumonia; the voice becomes low, monotonous and is finally lost. Fine contractions of the involved muscles may be observed. There are no changes of sensation and taste is not affected. The course of the disease is chronic and may last over a period of several years.

The prognosis is hopeless, death taking place from obstruction of the larynx by food particles, septic pneumonia or exhaustion.

Treatment consists in the employment of all possible means to maintain the patient's strength, and in the use of tonics, such as iron, arsenic, quinine and strychnine. When there is a syphilitic element in the history the use of mercury and potassium iodide is indicated. Electricity may confer some benefit; the galvanic current may be employed by placing the electrodes, one at each mastoid process, and faradism may act as a tonic upon the affected muscles. Galvanism may aid the patient in swallowing, the anode being placed at the back of the neck and the cathode at the side of the larynx; when the latter is moved along this organ it causes a reflex deglutatory act.

It is often advisable to begin to feed the patient by means of the stomach tube early in the disease.

ACUTE ASCENDING PARALYSIS.

Synonym. Landry's Paralysis.

Definition. An acute disease characterized by rapidly advancing paralysis beginning in the legs, progressing upward to the body and finally reaching the arms, causing death by involving the respiratory center in the medulla.

Ætiology. This disease affects males more often than females and is usually seen in healthy individuals in the prime of life (twenty to forty). Cases have been observed in which the abuse of alcohol has seemed to be a considerable factor in predisposing to the condition and the same may be said of syphilis. Of late there is more and more inclination to attribute the affection to a toxic infection of the peripheral nerves and spinal cord, since it, at times, occurs as a sequela of microbic diseases such as enteric fever, erysipelas, epidemic influenza, etc.

Pathology. The lesions found *post mortem* differ but it seems sure that the peripheral motor neurons are the seat of chief involvement; changes are also observed in the spinal cord resembling those of acute general myelitis or very similar to those occurring in peripheral neuritis.

Symptoms. Prodromata, such as loss of appetite, rise of temperature, pains in head and back, general malaise and tingling sensations in the extremities, lasting from a few hours to several days, are usually present. Following these a rapidly augmenting weakness of the legs appears, which, within a few hours or a few days, may become a complete paralysis. The paralysis soon extends to the trunk and in a day or two, or even less time the arms are involved. As the muscles of the neck and face become affected breathing is interfered with, the speech becomes indistinct, swallowing is difficult and other symptoms of bulbar paralysis develop and death occurs from respiratory paralysis. The reflexes are diminished or lost but may later return and become exaggerated, the sphincters remain continent, there is no muscular atrophy or tendency to bed-sores and the electric reaction usually remains normal but exceptionally there is loss of faradic excitability. As a rule sensation is not affected, except for the tingling occurring at the onset and the development of certain hyperæsthesiæ. Vaso-motor disturbances evidenced by œdema and hyperidrosis may be present. There is no mental impairment and seldom any febrile movement. Rarely patients have been observed in whom the paralysis has been of the descending type, the upper part of the body being involved first. Death may supervene here from involvement of the medulla before the paresis reaches the lower limbs.

The course of the disease may last but a few days before the fatal outcome or it may continue for several weeks, depending upon whether or not the vital centers are affected.

The prognosis is generally very unfavorable but in rare cases the symptoms have gradually ameliorated and recovery has ensued.

Treatment. The patient should be confined to his bed and counter-irritation applied to the spine by means of dry cupping, mustard pastes or the thermo-cautery. The bowels should be opened by repeated small doses of calomel followed by a saline and the activity of the skin and kidneys stimulated by diaphoretics, the warm bath, and the potassium salts (potassium

citrate or acetate, gr. x to xx—0.66–1.33—three times a day) in order to assist in the elimination of the toxin causative of the disease. If there is suspicion of syphilis, mercury biniodide, gr. $\frac{1}{50}$ – $\frac{1}{30}$ (0.0012–0.002) three times a day should be given. The use of ergotine is recommended by Gowers, he having administered gr. xx (1.33) in divided doses hourly with improvement of the symptoms, followed by recovery. The salicylates also are advocated and iron perchloride may be employed although it is probable that these drugs will influence the progress of the disease but little. The symptoms of respiratory or cardiac failure should be combated by the application of the electric current to the muscles of the chest and to the phrenic nerve and, in the patients who survive the acuity of the disease, this means should be employed to aid muscular and nerve regeneration.

The patient should lie upon the side rather than upon the back since the latter position tends to augment the congestion of the spinal cord. When swallowing becomes difficult the use of the stomach tube may be necessary in order to maintain the patient's nutrition and to prevent the lodgment of food particles in the respiratory tract.

SYRINGOMYELIA.

Definition. A condition of the spinal cord characterized by the existence in its substance of abnormal cavities which usually contain liquid and are surrounded by an increase of neuroglia tissue.

Ætiology. This disease may exist as the result of a congenital anomaly, of the degeneration of embryonal or gliomatous tissue in the cord or of a hæmorrhage, traumatic or due to arterial disease, into the cord substance.

Pathology. The spinal membranes remain normal but the surface of the cord is irregular, protuberances being seen in certain places, retractions in others. Over the prominences fluctuation may be obtained and puncture may reveal the presence of serous fluid. The cavities may be multiple, extending considerable distances up or down the cord, being usually largest in the upper dorsal and cervical regions, and may involve nearly the whole diameter of the structure even to the pons, converting it into a tube. The cavity may appear to be a dilatation of the central canal or it may be situated in the posterior portion displacing the central canal forward. The cavity is lined with neuroglia which may, before it degenerates and becomes softened, interfere with the function of the normal tissue of the cord. Upon the outskirts of this neuroglia the blood-vessels are more numerous than normal, they may be dilated and their walls may be the seat of sclerotic change.

Symptoms. While mild types of the disease may be evidenced by no symptoms, the onset usually occurs at from twelve to twenty years of age and is

of gradual development. The symptoms depend upon the situation of the lesion and consequently the neck, arms and upper thorax are most affected. The characteristic symptoms are disorders of sensation, particularly of the pain and temperature senses; touch is seldom affected but may be rendered less acute than normal. These disturbances chiefly involve the upper part of the body, but areas of pain sense disturbance may be observed in any part. Muscular weakness may occur and trophic changes in the skin and nails as evidenced by thickening, eruptions, or superficial gangrene of the former and corrugation, fissuring or even loss of the latter. The absence of pain sense may result in neglect of injuries and consequent superficial infectious processes and ulceration. Sweating, blueness, coldness, œdema and other vaso-motor disturbances may be observed. The joints of the upper extremities may become swollen, their cavities filled with fluid and their articular surfaces absorbed, a change analogous to that occurring in locomotor ataxia. The bones become brittle and are easily fractured and spinal curvatures may appear as a result of the atrophy of the muscles or involvement of the vertebræ. Secondary contractures of the hands may develop.

When the disease affects the medulla there may be partial laryngeal paralysis, dysphagia, lingual and facial paresis and disturbances of the heart action and respiration. The pupils may react sluggishly or be unequal. Involvement of the lumbar cord may produce paralyses of the rectum and bladder.

The prognosis. The course of the disease is chronic, extending over from ten to twenty years; its development is slow but as it nears its termination it progresses more rapidly. The ultimate result is invariably fatal, death supervening from exhaustion or involvement of the medulla.

Treatment. This is entirely without avail as far as checking the disease is concerned. The patient's strength should be maintained by nourishing food, tonics may be given and the administration of arsenic and silver has been recommended. The patient should be warned of the danger of traumatism and fracture and he should be protected against possible injury. Otherwise the treatment consists in the relief of the symptoms as they appear.

MORVAN'S DISEASE.

This is a condition analogous to syringomyelia and characterized by practically identical symptoms; necrotic infections due to trophic disorders are likely to be more severe. The *bacillus leprœ* has been found in the degenerated tissue in the cavity of the cord in certain cases. It is probable that further study will show that the so-called Morvan's disease is identical with syringomyelia.

HÆMORRHAGE INTO THE SPINAL CORD.

This is of rare incidence; it is met most frequently between the ages of twenty and forty although it has been observed during infancy. The condition may result from traumatism, it may occur in hæmophilic subjects, in conditions of asphyxia, illuminating gas poisoning, for instance, in the severe convulsions of epilepsy, eclampsia, tetanus, etc., after excessive coitus and as the result of aneurysmal rupture or arterial disease. The hæmorrhages may be single or multiple, are usually in the gray matter and may be sufficiently large in quantity to burst through the white substance to the pia. After the extravasation of the blood the tissues of the cord become soft, degenerated red blood cells and leucocytes and small round cells are seen and the cord substance is tinged with the coloring-matter of the blood. Later the involved area may develop into a connective tissue cicatrix, become the seat of fatty degeneration, or the clot may be absorbed, leaving a cavity behind.

Symptoms. The onset of this condition is usually sudden with feelings of numbness quickly followed by paralysis of the lower limbs, with loss of sensation and, perhaps, ataxia; there is loss of vesical and rectal control, the reflexes are lost but soon return and become increased; there may be severe pain referred to the spine or to the abdomen, chest or limbs. If the upper dorsal or the cervical region is involved the arms and chest are affected. The acuity of the symptoms lessens after about a week and the condition then resembles that present in chronic myelitis. Spasmodic contractions may appear and muscular atrophy may ensue resulting from injury of the anterior horn cells. If the extravasation of blood is large, improvement may not take place and the affection may result in death with symptoms of acute myelitis.

The characteristic symptoms of spinal hæmorrhage are the very sudden onset and the pain.

The prognosis is dependent upon the situation and volume of the hæmorrhage. It is least serious in the dorsal region, most in the cervical.

Treatment. The patient should be put to bed and kept absolutely at rest, cold applications should be made to the spine in the form of ice bags and the circulatory irritability should be lessened by the administration of aconite; restlessness may be controlled by the bromides. Otherwise the treatment is entirely symptomatic. Ergot has been recommended and may be tried.

The treatment of the chronic stage consists in the exhibition of the iodides in the hope of lessening the tendency to the production of connective tissue growth at the site of the lesion, together with the employment of the other means discussed under the treatment of chronic myelitis (p. 753).

COMPRESSED-AIR DISEASE.

Synonyms. Caisson Disease; Diver's Paralysis; "The Bends."

Definition. A disease caused by suddenly emerging from air under high pressure into that of normal pressure, and characterized by dizziness, pains in the head and joints, especially the knees and elbows, and in severer instances by motor and sensory paralyses of the legs of greater or less degree.

Ætiology. This condition is met in artisans who have been working under heavy atmospheric pressure in caissons such as are employed in the construction of subaqueous tunnels, bridges, piers, foundations of buildings and the like. The disease seems to depend upon disturbance of the central nervous system caused by the sudden change of atmospheric pressure attendent upon emergence from caissons, in which the pressure may be as high as sixty pounds to the square inch in excess of the normal fifteen pounds, into the ordinary atmosphere. Some persons seem to be more susceptible to the disorder than others and it is unlikely to occur unless the individual has been subjected to the pressure for an hour or more. Those unaccustomed to working under pressure are more likely to be attacked than those regularly engaged. The status lymphaticus may be considered a predisposing cause.

Pathogenesis and Pathology. Various theories of the pathogenesis of this disease have been advanced but in the light of recent research it seems probable, if not certain, that it is the result of gas emboli in the circulating blood. Air under pressure, according to experiments performed by Brooks, is absorbed by inert fluids, by certain inert tissues, and by dead and living animal tissues, and the amount of absorption depends, to a great degree, on the degree of the compression, according to Dalton's law; on release of the pressure air is liberated from these substances in quantity according to the degree of previous absorption. When rapid liberation takes place in dead or living animal bodies, it causes dilatation of the lymph passages, rupture of the capillaries and the production of tissue laceration by the escaping gas bubbles. Frequent repetition of these lesions in living tissues causes endothelial and interstitial proliferation with tissue necrosis in and about the diseased vessels and eventual secondary inflammatory changes.

The symptoms of compressed-air disease admit of this explanation and the clinical manifestations are produced in this manner. They are succeeded in sub-acute or chronic instances of the affection by secondary degenerative inflammatory lesions which may be grouped as myelitis. In view of these facts it seems justifiable to conclude that the essential ætiologic factor is the rapid liberation of gas from the body fluids and tissues when decompression is allowed to take place too rapidly. This liberation of gas bubbles causes laceration of the soft tissues, dilatation of the lymph spaces and capillary hæmorrhages.

At autopsies upon bodies of patients dead from compressed-air disease, free gas is found in the chambers of the heart, in the arteries, capillaries, and in the lymph spaces; capillary ruptures are found and diffuse parenchymatous myelitis, with degeneration in the posterior and in the adjoining lateral columns of the cord, has been demonstrated in subjects who have survived long enough for such changes to take place.

Symptoms. Individuals suffering from compressed-air illness usually exhibit the affection in one of four main types:

1. "*The Bends.*" This is the mildest form of caisson disease and is characterized by pains of varying severity. These are most common in the limbs; one limb or all may be affected, but the legs suffer more commonly than do the arms. The pains may be extremely severe; they are continuous, as a rule, but paroxysmal exacerbations may be observed. The pain is increased on motion, but there is no swelling, and tenderness is sometimes not notable. Itching of the skin is a frequent symptom. Abdominal cramps are not uncommon, and a condition termed "*the chokes*" is occasionally seen. This is characterized by cough, a sense of oppression of the chest, and some difficulty in respiration. The symptoms described, like all the manifestations of compressed-air illness, usually appear within an hour after emergence from the compressed air. Under treatment the pains disappear, as a rule, but they may be persistent, and sometimes reappear after apparent recovery.

2. "*The Staggers.*" This type of compressed-air illness is characterized by dizziness and staggering. At times the latter may be so marked that the patient falls, usually to one side or the other, unless he is supported. Vomiting may be present and the pulse may be rapid and weak. Spots may appear upon the skin of the abdomen, back, and limbs; these are purplish in color, and vary in size from that of a finger-nail to that of a quarter-dollar. There may be dimness of vision and nystagmus. The condition of the pupil is variable. The hearing is often diminished in acuity, but the patient will usually answer rationally upon loud questioning. There is seldom any mental disturbance. Pains in the limbs or abdomen may be present, and numbness of the extremities may be noted.

3. *The Paralytic Type.* The motor and other symptoms of this type of the affection are in no way characteristic. The loss of motility may be gradual or sudden, and there may be monoplegia, hemiplegia, or paraplegia; the last is perhaps more common. Sensation may be delayed or absent, or there may be irregular areas of anæsthesia which sometimes occur without paralysis. The reflexes may be normal, lost, or exaggerated, and a spastic condition of the limbs has been noted. There frequently is retention of urine necessitating catheterization; more rarely there is paralysis of the bladder and the rectum, with incontinence. The mind, as a rule, remains clear.

The paralyses may disappear permanently upon treatment; they may be

temporarily relieved, to occur again, or they may resist all efforts. As a rule, however, they are not permanent, although months may elapse before entire recovery takes place.

4. *The Comatose Type.* In this type the most prominent symptom is partial or complete coma, which may appear suddenly after emergence from the pressure or may be preceded by other manifestations of the affection, more particularly those described under the second form of the disease. In the semi-conscious patients active delirium may be present. The coma of caisson disease is in no way characteristic. The patient may suddenly become unconscious and die within an hour, or less, of cardiac or respiratory failure, the pulse growing weaker and weaker and the respiration increasingly slower until the end ensues. Comatose patients usually exhibit cyanosis of the lips and face. The skin is moist with a cold perspiration; the pupils may be normal, dilated, contracted, or unequal; their reaction may be sluggish and nystagmus may be observed. The pulse is often weak, thready, and irregular, and the respiration stertorous. There may be frothing at the mouth, nosebleed, vomiting, sometimes with blood, and the rectum and bladder may be incontinent. The limbs may be flaccid or rigid, or there may be convulsive movements. The reflexes are in no way typical. The temperature may be normal or elevated. A fatal outcome is the rule in almost all instances in which absolute coma is present.

The foregoing classification should not be considered absolute, since the symptoms of the various groups are often so interwoven as to make arbitrary division quite impossible.

Prevention. Toward prophylaxis of the affection much can be accomplished by taking certain precautions. All applicants for work under pressure should be subjected to as rigid a physical examination as that considered necessary for an individual applying for life insurance.

The conclusions may be drawn that the laborer in compressed air should not be younger than twenty nor older than thirty-five years, that his muscular system should be, at least, normally developed, that his eyes and ears should be normal, and that his general physical condition should be in no way vitiated. It is usually the part of wisdom to disqualify, at least temporarily, subjects whose pulse is too rapid (above 100) or irregular, as well as those who give evidence of cardiac, arterial, pulmonary, hepatic, or renal disease. Alcoholism, unless the applicant exhibits the signs of this condition in its acute stage, is not a reason for disqualification, else it would be most difficult to obtain workers. Observation seems to show that the negro and the Anglo-Saxon races are less subject to the evil effects of air under pressure than are Italians, Poles, and other Eastern Europeans.

It has been held by pathologists, who have made autopsies upon subjects dead of compressed-air illness, that status lymphaticus is often present, and

consequently the signs of this condition should be sought as a part of the routine physical examination.

After having passed a satisfactory examination the candidate should be subjected to a preliminary test, that is to say, he should be put under a pressure of from twenty-five to thirty pounds for an hour and a half; following this he should undergo a second physical examination, and should there be no reason for his disqualification, he may be allowed to undertake work in the compressed air, after having received certain warnings and advice, as follows: The air chamber should not be entered unless the subject feels perfectly well, and it is unwise to begin work on an empty stomach. Intoxicants should be used sparingly, or, better, not at all; but little water should be drunk while under pressure, and the laborer should obtain at least seven hours' sleep per day. As the pressure is raised the fulness in the ears, which is caused by the difference in the pressure outside the membrana tympani and that within this structure, may be relieved by swallowing or by closing the mouth, holding the nostrils, and performing the act of blowing the nose. This forces the Eustachian tubes open and thus equalizes the pressure. Emergence from the compressed air must be slow; at least fifteen minutes (and still better, thirty) should be taken to come out from a pressure of thirty pounds, the pressure being allowed to fall not faster than two pounds per minute. The laborers should come out of the pressure as follows: At the end of the shift they enter the air lock, the pressure in which is equal to that in the caisson where they have been working. The door between the caisson and the air lock should be closed and the exit valve of the latter opened sufficiently to allow a slow and gradual outflow of the compressed air. When this has escaped and the pressure within the lock has become equal to that outside, the laborers should be liberated. After coming out hot coffee should be drunk freely, and warm, dry woolen clothing should be put on. All exposure to cold should be avoided and no undue exercise should be undertaken for at least an hour after emergence. Beer or other cold liquids should not be drunk for a considerable period after leaving pressure.

If the caisson is underground elevators should be provided to bring the laborers to the surface, for the climbing of ladders seems to predispose to the occurrence of the evil effects of working in compressed air.

Treatment. In the treatment of all types of compressed-air illness the first consideration is recompression of the patient, that is to say, he must be subjected to the further influence of compressed air. For this purpose so-called hospital locks should be provided. Such a lock may consist of a horizontal cylinder made of one-half to three-quarter inch boiler iron; a very practical size is about twenty-five feet in length by seven feet in diameter. The lock should be divided into two chambers by a partition in which is an air-tight door opening inward. The open end of the lock should be fitted

with a similar door. The double-chambered lock is the most practical type, for since both chambers are supplied with outlet and inlet valves, a means is thus afforded whereby the patient can be visited by an attendant without reducing the pressure to which the former is being subjected.

Usually when the patient, if suffering merely from the first type of the affection, and especially if he has applied for treatment soon after the onset of his symptoms, is subjected to recompression he experiences very striking relief, the pains disappearing entirely long before the height of pressure in which he has been accustomed to work has been reached. The pressure is allowed to rise, even after relief is evident, to a height equal to that in which the patient has been working, and then he is "decompressed," that is, the pressure is slowly lowered to normal at the rate of about one-half pound per minute. Even slower decompression may be advisable in severe forms of the disease. Valves are obtainable which so control the outlet of air that the time necessary for the outflow of a given amount is the same whether the pressure within the lock be high or low. It must not be forgotten that it is necessary to supply the lock with a certain amount of fresh air after the inlet valve has been closed, otherwise the patient would be in danger of suffocation.

In treating instances of compressed-air disease it is unwise to subject the patient to the maximum pressure for more than five or ten minutes. When relief is experienced from the pain of an ordinary attack of the "bends" the patient is directed to move about the lock and to exercise and rub the affected part with a counterirritant ointment. In most of the mild cases the patient leaves the lock wholly relieved, but if there is a return of the pain recompression is advisable, the pressure being allowed to ascend until the pains disappear, when slow decompression is instituted as before. A third or even a fourth recompression may be employed if necessary, but usually the relief experienced from these subsequent treatments is temporary and slight in character. It is wise, if there is still continuation of the pain after the patient has been sufficiently recompressed, to advise thorough rubbing of the painful part with a counter-irritant ointment or liniment. The following are suggested: Capsicum oleoresin 2 parts, oil of turpentine 5 parts, oil of rosemary 5 parts, camphor 5 parts, olive oil 5 parts, petrolatum sufficient to make 100 parts; or menthol 10 parts, methyl salicylate 5 parts, hydrated chloral 10 parts, lanolin to 100 parts. The faradic current, applied as strong as can be comfortably borne, and the high-frequency current and vibratory massage, may prove beneficial; hot baths, hot-water bags, and the electrotherm, are very helpful adjuncts. Ironing the painful part with a hot flat-iron, a flannel cloth being interposed between it and the skin, is also suggested.

The persistent pains may be relieved by analgesics, such as salipyrine 10 grains (0.66) every two hours, acetanilide 5 grains (0.33) every four hours,

or acetphenetidine 10 grains (0.66) every three hours. These drugs should be given with care, and, if there is any tendency to heart weakness, they should be combined with citrated caffeine. Codeine may also be prescribed. Rarely are the symptoms severe enough to warrant the employment of morphine. In the management of all forms of the condition other than that characterized by pain, little in the way of specific treatment aside from decompression can be done.

Much, however, can be accomplished in the more serious types by the employment of symptomatic measures: when cardiac or respiratory weakness is evident hypodermatic stimulation with strychnine, adrenalin chloride, caffeine, etc., should be resorted to. Artificial respiration may be indicated, and stimulation, by means of enemas of hot coffee, is always advisable in comatose patients. All these measures may be applied by attendants while the patient is under pressure in the hospital lock. Sometimes the results attained, even in patients in coma, are surprisingly good. Oxygen may be administered if there is respiratory failure, but should not be given while the patient is under pressure.

The after-treatment consists in careful nursing, feeding with nourishing food, and the use of tonics. Patients affected with persistent paralysis should receive the routine treatment of chronic myelitis.

COMPRESSION OF THE SPINAL CORD.

Synonyms. Compression Myelitis; Pressure Paralysis of the Spinal Cord.

Compression of the spinal cord may be caused by various lesions and results in paralyses differing in degree and character. Among the causes of cord compression may be mentioned neoplasms, syphilitic and inflammatory thickenings of the spinal membranes, spondylitis, particularly that due to tuberculous processes (Pott's disease), malignant new growths and injuries of the vertebræ, cysts of the spinal canal due to the echinococcus or the cysticercus, erosion of the vertebræ and consequent pressure upon the cord due to aortic aneurysms, malignant retroperitonæal neoplasms and collections of pus, retropharyngeal abscesses, etc.

Pathology. At the site of the compression the cord may be smaller in size than normal, and irregular in outline on cross section; in recent lesions it may be softened but in compression of long standing its consistence may be harder, due to the replacement of previously degenerated areas by connective tissue. Microscopically, the nerve fibres are swollen and fatty degeneration may be observed, later this condition is replaced by a growth of connective tissue of more or less firmness depending upon the duration of the pressure. Ultimately, secondary ascending and descending degenerations may occur.

Symptoms. In the most common variety of compression myelitis—that

resulting from Pott's disease—the deformity may have existed for a long period before any symptoms resulting from cord compression appear, while in instances due to intra-thoracic or abdominal lesions, the cord symptoms may be noted first. Pain is an early symptom and varies in degree from a dull ache at the site of the pressure to very marked pain. The discomfort is increased by bending the back. If the pressure is upon the nerve roots the pain may be situated in the distribution of the nerves having their origin in the roots affected. There are sensations of numbness and tingling. Sensation is not likely to be disturbed although anæsthesia may occur in lesions of long standing. Later, symptoms of motor disturbance, usually not symmetrical at first but affecting one leg or arm before the other, may be noted; these consist of muscular stiffness and varying disorders of motility ultimately becoming complete paralysis.

As would be expected the symptoms differ with the area of the cord affected. When the pressure is exerted upon the upper part of the cord just below the medulla, movement of the neck may be accompanied by pain and the neck muscles may be the seat of spastic contractions; in marked instances it may be impossible to move the head. If the lesion is in the lower cervical cord the muscles of the neck may be rigid while sensory and motor disturbances of the arms may occur. The skin and tendon reflexes are increased, because of interference with the passage of inhibitory influences, the knee jerk is exaggerated and ankle clonus is present.

In pressure upon the dorsal and lumbar regions the legs only are affected although in lesions involving the dorsal cord only, there is likely to be pain in the distribution of the intercostal nerves, the girdle sensation may be present, and there is ankle clonus with augmented patellar reflex. In involvement of the lumbar cord there are motor and sensory disturbances in the legs, the reflexes are diminished and vesical and rectal incontinence, preceded by difficult micturition and constipation, may occur.

Trophic disorders evidenced by a tendency to bed-sores, atrophy of the muscles of the paralyzed parts, skin eruptions, desquamation and dryness of the nails may be observed.

The prognosis in compression due to Pott's disease is good because of the possibility of removing the cause of the lesion, in that due to other causes it is unfavorable. It is possible for the symptoms to disappear even after they have endured for months.

Treatment varies with the cause of the condition; that of Pott's compression consists in the use of appliances calculated to reduce the deformity and in the administration of antituberculous medication, codliver oil, creosote, especially in the form of the carbonate, iron, arsenic and other tonics combined with plenty of fresh air, proper exercise and nourishing food. Suspension has been employed with good results in the earlier stages. When the

condition is the result of syphilitic gummata or meningitis the administration of mercury and potassium iodide is indicated.

The pain may be relieved by the coal tar analgesics, such as salipyrine, acetphenetidine, acetanilide; hydrated chloral and morphine may be employed as last resorts only, on account of the possibility of habit formation. When this symptom is due to cervical meningeal thickening counter-irritation by means of the electro- or thermo-cautery may be beneficial.

The muscular twitchings should be combated by the bromides.

Rest and hydrotherapeutic measures, especially warm baths, are important adjuncts to treatment.

Massage and electricity influence the course of the disease not at all but may be used to maintain the nutrition of the atrophied muscles.

Compression by neoplasms necessitates surgical intervention. The removal of non-malignant growths may be followed by recovery, that of malignant tumors by temporary benefit only, as a rule.

Laminectomy is necessary in conditions of fracture and dislocation compression and has been employed in tuberculous spondylitis. Surgical treatment is also indicated in pressure upon the cord resulting from intra-thoracic and intra-abdominal abscesses. Aneurysmal compression may be treated by the various operations advocated for the relief of the primary condition.

TUMORS OF THE SPINAL CORD AND ITS MENINGES.

Tumors causing symptoms referable to the spinal cord are of various types and origin. They may arise from the bones, cartilages, or ligaments of the spinal column—enchondroma, sarcoma, carcinoma—in the tissues of the extradural space and from the outer surface of the dura—sarcoma, carcinoma, lipoma and tumors resulting from the growth of hydatids or cysticerci—in the spinal membranes—sarcoma, tuberculoma, syphiloma and parasitic growths—in the substance of the cord—glioma, tuberculous and syphilitic tumors, sarcoma and myxoma. Mixed tumors in any of these situations may occur. The tumors most commonly found are those due to syphilis and tuberculosis, and sarcomata. Parasitic growths are seldom met. New growths also develop in the spinal nerve roots inside the dura; these may be myxomata, fibromata, lipomata, neuromata or tumors of mixed character.

Spinal neoplasms are usually single but multiple neuromata or sarcomata sometimes occur. In size they seldom reach a greater diameter than two inches and frequently they are much smaller than this; when within the spinal canal their growth is limited by its calibre.

Symptoms. Slowly developing tumors may exist for considerable periods before causing noticeable symptoms; when these appear they depend upon the site of the growth and the pressure exerted by it.

The chief symptoms are sensory and motor. Pain is likely to be the earliest of these and is usually due to the pressure of the tumor upon the sensory nerve roots. It is of varying character. It may be a dull ache or a burning, stabbing pain or a girdle sensation. Its situation differs in accordance with the nerve roots involved, it may affect one or both sides of the body, and appears first at the termination of the nerves upon which the pressure is exerted. There may be anæsthetic and hyperæsthetic areas. Spinal pain, increased upon motion, and tenderness are sometimes present.

Motor symptoms consist of spastic contractions, marked oftentimes, if the tumor is meningeal, and muscular rigidity at the level of the lesion; this may aid in diagnosticating the site of the tumor. Spasm of the arm and leg of one side suggests a tumor on the corresponding side somewhere in the cervical region, whereas, if the muscles of the leg only are affected, the growth is likely to be in the dorsal cord. Paralysis gradually develops as the tumor increases in size and may finally become complete. If the neoplasm is in the cervical region this symptom affects both arms and legs, if below this level the lower limbs only. The paralysis may be more marked on one side if the tumor presses more upon one side of the cord than upon the other.

Sensation is finally lost in the paralyzed parts if the tumor is below the sixth dorsal segment, but if it is above this point and eccentric, the sensory disturbance is likely to be greater upon the side affected by the smaller amount of motor disturbance.

Vaso-motor disorders, œdema, mottling of the skin, etc., may occur and if the lesion affects the cells of the anterior horns muscular atrophy results. Ascending and descending degeneration of various tracts of the cord may occur in cases of long standing, and true myelitis may at any time be engrafted upon the primary condition and obscure the diagnosis.

The typical manifestations of spinal tumor are the gradual appearance of symptoms referable to the spinal nerve roots, first of one side, later of the other, and the development of motor and sensory paralysis. The fact that the pain is, as a rule, at the level of or slightly below the growth (it is never above), is of practical value in ascertaining the seat of the growth. The character of the growth is difficult of diagnosis unless a history of syphilis or the presence of tuberculous disease in other parts of the body can be made out.

Treatment. This depends upon the cause of the compression and naturally should be directed toward the relief of that condition. The treatment of Pott's disease compression consists in the alleviation of the deformity by orthopædic apparatus and constitutional treatment directed against the causative tuberculous infection. The means at our disposal are the administration of codliver oil and other tonics, the insistence upon proper hygiene and plenty of nourishing food.

Compression resulting from growths of syphilitic tissue necessitates vigor-

ous anti-luetic treatment; in that due to tumors of gliomatous or sarcomatous type arsenic and silver nitrate may be administered, with little hope of benefit, however. The consideration of surgical interference is pertinent in all forms of neoplasmic compression and the earlier this form of treatment is undertaken the more likely will it be to relieve the condition. Tumors outside the dura are not difficult of removal, and even those in the cord substance may be operated upon with some benefit. When there is certainty of the presence of a new growth exploratory operation is justifiable and, when done by skillful hands, is of comparatively slight danger.

SPINAL MENINGITIS.

SPINAL PACHYMENINGITIS.

Definition. An inflammatory condition of the dura mater of the spinal cord.

While attempts have been made to separate the inflammations involving the outer layer of the spinal dura, such as those resulting from the extension of inflammations, especially tuberculous, of the bones of the spinal canal, from those involving the inner layer of this structure, it is both difficult and unnecessary from a symptomatologic as well as from a pathologic standpoint to do so since the pachymeningitis externa rarely exists as a distinct entity, the inflammation extending in almost every case to the inner layer of the dura, a pachymeningitis interna resulting, with, oftentimes, an involvement of the pia of the cord as well.

Of pachymeningitis interna, two forms are distinguished; cervical hypertrophic pachymeningitis and hæmorrhagic internal pachymeningitis.

The former is a chronic inflammation due to syphilitic infection, the abuse of alcohol or exposure to cold. The dura of the cervical region is involved to a greater or less extent of its area and pathologically the process consists of an exudation of fibrinous tissue, occurring in successive layers upon the inner surface of this membrane and, at times, resulting in adhesions between it and the adjacent pia.

Symptoms. These are referable to the compression of the cord by the fibrinous exudate and consist of pain in the arms, and in the back of the neck and head; with this, disorders of sensation, numbness, tingling and herpetic eruptions may be observed. These symptoms are due to pressure upon the roots of the nerves supplying the affected parts.

After the pain has been present for a period of from a few weeks to several months, paralysis with muscular atrophy, resulting from pressure upon the anterior nerve roots, appears. In consequence of the location of the lesion

the arms are chiefly affected, they become weak, and atrophy, resulting in contractures of different sets of muscles, takes place. Sometimes there may be areas of cutaneous anæsthesia.

Still later, if the growth of new tissue increases further, a spastic paralysis, due to interference with the motor tracts of the cord, occurs; the reflexes are exaggerated; there is no atrophy but in cases of long standing there may be anæsthesia, rectal and vesical paresis and a tendency to the development of bed-sores. While the course of the disease is chronic it does not in itself jeopardize life and treatment may result in improvement.

Treatment. If the disease is of syphilitic origin the treatment consists in the employment of usual means adapted to specific disease. The pains may be relieved by antipyrine, acetphenetidine, codeine, etc. Hydrotherapeutic measures and electricity are to be recommended, together with the application of counterirritation, especially the Paquelin cautery, to the back of the neck. Where the condition is the result of bone disease, tuberculous or otherwise, orthopædic or other surgical treatment is indicated.

Hæmorrhagic pachymeningitis is very rare and is seldom diagnosticated *intra vitam.* It may occur at any level of the cord, its symptoms resemble those described above and it frequently co-exists with hæmatoma of the cerebral dura.

ACUTE SPINAL LEPTOMENINGITIS.

Acute inflammations of the pia mater of the cord, aside from cerebrospinal meningitis of the epidemic type, occur as the result of tuberculous infection, secondary to the acute infectious diseases, following exposure to cold or injury and from the extension of infections of the cerebral meninges.

Pathology. The membrane is first swollen and hyperæmic. later there is exudation of serous or purulent fluid into the meshes of the pia and the arachnoid; these membranes are infiltrated with round cells and adhesions and thickenings result. Secondary changes may take place in the cord and spinal nerve roots, the final pathological change consisting of areas of sclerosis in these tissues.

Symptoms. These are, at the onset, those of acute inflammatory processes of other parts, namely, a chill, followed by rise of temperature, headache, malaise and general pains; these last occur especially in the back and limbs and are increased by motion. There are stiffness and muscular rigidity of the spine as well as sensitiveness of the spinal nerves. Kernig's sign—an inability of the patient, when the thigh is flexed at a right angle to the body, to extend the leg upon the thigh—is present. The reflexes are often increased, later, however, loss of reflexes with paralysis occurs, should the inflammation be of severe type. There may be vesical and rectal disturbances and trophic

disorders evidenced by blueness or pallor of the skin and a tendency to bed-sores may appear.

The course of the affection varies; death may supervene within from a few days to several weeks, due to involvement of the cranial nerves by reason of extension of the inflammation to their foci of origin. Complete recovery may take place in mild instances while after attacks of severe type the patient is often left with permanent localized motor, sensory or trophic lesions.

Lumbar puncture reveals the presence of an increased quantity of cerebrospinal fluid which escapes in drops through the needle, or if there is a considerable augmentation in its amount, the fluid will spurt forth in a stream of more or less force. Bacteriological examination of the fluid may show the cause of the lesion and by cytological examination more or less light may be thrown upon the ætiological factor of the inflammation. If meningitis is present the fluid is rarely clear and contains no sugar. Tuberculous fluid is, as a rule, quite turbid; in acute processes the number of leucocytes is likely to be large and chronic meningitis is usually evidenced by a relative increase in the number of mononuclear lymphocytes. Fresh blood is usually due to the puncture while decomposed blood may be found following injury or in cases of pachymeningitis.

The prognosis is, as a rule, unfavorable, especially in the tuberculous form. Instances secondary to the infectious diseases may recover.

Treatment. This consists in absolute rest in bed in a dark room, the employment of sedatives and of the other therapeutic means discussed under the treatment of epidemic cerebrospinal meningitis (p. 109).

Chronic spinal leptomeningitis may result from the continuation of an acute process particularly epidemic cerebrospinal meningitis, from the extension of chronic cord inflammations, syphilitic infection and chronic alcoholism. When this condition exists the membranes become thickened and opaque, adhesions to the surface of the cord are formed and the cord itself under these adhesions may be the seat of an inflammatory process (meningomyelitis). The walls of the blood-vessels are thickened and in cases due to syphilis gummata may be found; frequently there is a co-existent chronic inflammation of the cerebral meninges.

Symptoms. These are not well marked and consequently the condition is seldom diagnosticated. A chronic and obstinate stiffness of the back and limbs is the principal manifestation and with this are cramp-like pains, sensory and motor disorders and, when the lower segments of the cord are affected, there may be vesical and rectal disturbances.

Lumbar puncture reveals an increase of the cerebrospinal fluid.

Treatment consists in the employment of every possible measure to maintain the patient's general health. In syphilitic cases appropriate specific treatment in the form of mercury and the iodides should be administered.

Warm baths should be taken either at home or at natural springs. These not only in themselves benefit the patient but are an important adjunct to the antisyphilitic treatment. Counterirritation by means of the Paquelin cautery is often useful.

HÆMORRHAGE INTO THE SPINAL MEMBRANES.

Synonyms. Hæmatorrhachis; Meningeal Apoplexy.

Spinal meningeal hæmorrhage occurs either without the dura—extrameningeal—or between the dura and the pia—intrameningeal.

The former condition, as a rule, is due to injury—fracture, gunshot-wound or puncture—or is the result of aneurysmal rupture.

Intra-meningeal hæmorrhage is not often seen but may occur in malignant forms of the infectious diseases, or due to rupture of aneurysms of the basilar or vertebral arteries. It has been observed *post mortem* in conditions associated with convulsions, such as tetanus, strychnine poisoning or epilepsy.

In extradural hæmorrhage the blood is extravasated from the veins which surround the dura; the quantity of the blood varies from a small amount, forming a clot which covers but a small area, to a quantity sufficiently extensive to extend the entire length of the cord, in which case it may cause a considerable compression. It most frequently occurs in the cervical region.

The quantity of subdural hæmorrhage is also variant. The clot may be so small as to extend along the cord for an inch or two or of sufficient size to fill the entire subarachnoid space; rarely it may extend into the ventricles of the brain.

Symptoms. These may be wholly absent unless the hæmorrhage is of sufficiently large amount to compress the cord. In this case they vary from hardly recognizable manifestations to those of marked compression—sudden severe pain in the back extending to the lower part of the trunk or to its ventral surface, muscular twitchings or even a local or general convulsion. Following these symptoms motor and sensory paralyses develop, seldom, however, are these complete. The symptoms differ with the location of the extravasation, cervical hæmorrhage being evidenced by pain or anæsthesia in the neck and arms, which may be followed by paralyses of both arms and legs, there may be difficulty in respiration and deglutition and pupillary disturbances. Dorsal hæmorrhage is accompanied by pain in the back, thorax and abdomen, followed, it may be, by paraplegia, the reflexes remaining normal. In hæmorrhage in the lumbar region the pain and paralysis affect the legs, the reflexes are lost and there are vesical and rectal disturbances.

Death may occur within a few hours if the hæmorrhage is of large extent, while small clots may be absorbed, the symptoms disappearing as this takes place; in other cases the patient lives but permanent paralytic conditions

remain. Cervical hæmorrhage is most serious on account of the likelihood of involvement of the medulla.

Treatment. The patient should be kept absolutely at rest and preferably upon his side or face lest the blood accumulate along the posterior columns of the cord; the bowels should be kept open by the administration of fractional doses of calomel and the milder salines. Counter-irritation to the spinal region by means of leeches or dry cups may be employed but the use of ice bags is preferable. The nervous and circulatory excitation may be controlled by small doses of the bromides (10 grains—0.66—every two or three hours) and aconite tincture (5 drops—0.33—every two hours) until the desired effect has been accomplished. Later, potassium iodide or the syrup of hydriodic acid may be given in the hope of facilitating absorption and when the acute stage has passed the usual means—massage, electricity and hydrotherapeutic measures—calculated to bring about a return of normal muscular and nervous tone, may be employed.

In massive hæmorrhages with symptoms of marked compression operative intervention with a view to the alleviation of this condition may become advisable.

DISEASES INVOLVING CHIEFLY THE PERIPHERAL NERVES.

NEURITIS.

Definition. An inflammatory process affecting a nerve. The inflammation may involve one nerve (*localized neuritis*) or many (*multiple* or *polyneuritis*). When the condition affects only the tissue surrounding the nerve it is spoken of as a *perineuritis*, inflammation of that tissue within the nerve which encloses the bundles of nerve fibres is termed *interstitial* neuritis, while a *parenchymatous* neuritis is an affection of the nerve fibres themselves.

Ætiology. Neuritis may be caused by exposure to cold; by injuries to a nerve trunk from contusions, wounds or stretching, such as may occur in fractures or dislocations; by pressure from aneurysm, new growth or the constant use of a crutch or tool; by extension of inflammation of adjoining parts; by the poisons of acute infectious diseases, typhoid fever, diphtheria, etc.; by gout, purinæmic conditions and syphilis. It also occurs, more especially in its multiple form, as a result of alcoholism and of chronic metallic poisoning, particularly that due to arsenic and lead and may rarely follow long continued use of sulphonmethane or sulphonethylmethane.

Pathology. The affected nerve is first red, swollen and congested, the perineurium and nerve substance are likely to be infiltrated with extravasated white blood cells and there may be an increase in the neuroglia tissue. The process having reached this stage either undergoes resolution, goes on

to complete destruction of the nerve or the increase of connective tissue continues until the nerve undergoes atrophy and is wholly replaced by this substance. In the parenchymatous variety, the employment of the microscope reveals a swelling and opacity of the myelin substance and later a granular degeneration; finally the myelin and the axis cylinder degenerate, only the nerve sheath remaining, this later becoming converted into connective tissue.

Symptoms. In localized neuritis pain, increased on motion, and tenderness along the course of the nerve extending even to its termination, are the dominant symptoms. The pain is usually worst at the site of the inflammatory process although it may affect the distribution of the nerve as well, and more rarely the entire limb. In very mild instances there may be only numbness and tingling but in those of severer type the pain is apt to be aching, burning or lancinating in character; it is usually worse at night. Trophic changes occur such as œdema, glossing of the skin, sweating, increased surface temperature and muscular wasting. Motor disturbances, such as spasmodic contractions or partial paralysis, are not infrequent.

The electric reaction may be unchanged in mild types; in severer instances the response to electric stimulus is slow and the reaction of degeneration, i.e., loss of faradic excitability in both muscle and nerve and of galvanic reaction in the nerve, while the galvanic excitability of the muscle is changed so that the cathodal closure contraction is less than or about equal to the anodal closure contraction, is observed; the cathodal closure contraction is greater in the normal muscle than the anodal closure contraction.

The course of the disease varies, some patients recovering within a few weeks, while others continue to the chronic stage, recovering gradually after months of disability; instances due to injury or cold are favorable while those resulting from the extension of adjacent inflammation are the most severe. When recovery is imminent the reaction of the nerve to galvanic stimulation gradually reappears.

Symptoms of Neuritis of Special Nerves. *Facial neuritis* is particularly likely to result from exposure to cold and is accompanied by paralysis of the muscles supplied by the nerve. *Median neuritis* is evidenced by pain and motor symptoms in the palmar surface of the thumb, index and middle fingers and radial side of the ring finger.

In *ulnar nerve* involvement the symptoms are confined to the ulnar side of the ring finger and the little finger with atrophy of the muscles supplied by this nerve. *Musculo-spiral neuritis* is characterized by pain affecting the arm and forearm with motor disturbances in the muscles supplied. Wrist drop may occur in severe cases. In neuritis of the *circumflex nerve* the motor and sensory disorders are confined to the region of the deltoid and teres minor muscles.

Inflammations of the *brachial plexus* produce a combination of the symp-

toms ascribed above to affections of the various branches of this structure, numbness and tingling in the arm, pain upon axillary pressure and upon raising the limb, loss of muscular power and trophic disorders.

Treatment. This consists in eradicating the cause, if possible, in relieving the pain, in combating the inflammatory process and in assisting the regeneration of the diseased nerves.

When the condition is dependent upon constitutional disorders, such as syphilis or purinæmia, appropriate treatment should be employed; inflammations of adjoining structures should receive attention, fractures and dislocations should be reduced and causes of pressure removed.

The importance of rest cannot be over-estimated. The limb may be put up in splints or sand bags may be applied along its sides; the advantage of the latter procedure being that it renders the employment of local measures more easy. The pain may be controlled by various local applications such as compresses of 10 to 20 percent. ichthyol ointment, hot compresses or poultices of flaxseed, or ice bags. The actual cautery is useful, its application being rendered painless by means of the ethyl chloride spray. Rubbing with counter-irritant liniments, such as that composed of equal parts of menthol, hydrated chloral and camphor, may be effectual. In cases of severe pain the administration of the coal tar analgesics is indicated; of these salipyrine (gr. x—0.66) given every hour until relief is experienced is perhaps the best; acetphenetidine, gr. v to x (0.33–0.66) three times a day, acetanilide, gr. v (0.33) every four hours or antipyrine, gr. x (0.66) three times a day may be employed. If there is any tendency to heart weakness these drugs should be used with caution and it is wise oftentimes to add a grain (0.065) of citrated caffeine to each dose. Codeine or morphine in small doses may be added to any of the above drugs if their analgesic effect is insufficient. Codeine alone may be employed (gr. i–ii—0.065 to 0.13) and when the pain resists all less potent remedies, recourse to morphine may become necessary. This drug should be given hypodermatically and with extreme caution since the liability to establishment of the habit is great. Under no circumstances should the patient be allowed to use the syringe. Hypodermatic injections of cocaine hydrochloride, gr. $\frac{1}{8}$ to $\frac{1}{3}$ (0.008–0.022) and of beta eucaine hydrochloride in the same dosage may be useful. The injection should be given at the seat of the pain.

Potassium (not sodium) salicylate may be given with benefit in certain cases and massa hydrargyri, one or two grains (0.065–0.13) daily has been recommended.

When the acute stage of the inflammation is past measures should be taken to bring about a regeneration in the affected nerves. Here potassium iodide may at times be found useful but the so-called nerve tonics—strychnine in moderately large doses (gr. $\frac{1}{30}$—0.002—three times a day) either alone or com-

bined with quinine and phosphorus,—are more usually efficacious. The tendency to atrophy of the muscles and the loss of nutrition of the affected parts indicate the employment of electricity, massage, hydrotherapeutic measures and passive movements. These, however, should not be instituted while tenderness persists or if they seem to exhaust the diseased parts. Electricity may be given, in proper instances, daily but for not more than a few moments. The faradic current is an excellent means for restoring both sensation and motility, but it should never be given strong enough to cause discomfort. The interrupted galvanic current is indicated if there is no response to faradism, but the latter should be substituted as soon as regeneration has so far taken place as to bring about a return of faradic irritability. Warm baths, massage and movements also aid in restoring the normal condition of the part by stimulating the circulation and thus improving the disordered state of the nutrition.

MULTIPLE PERIPHERAL NEURITIS.

Synonym. Polyneuritis.

Definition. An inflammation of a number of the peripheral nerves at the same time.

Ætiology. Multiple neuritis may result from the introduction into the body of various poisonous substances; of these the most common is alcohol; other exogenous causes are lead, arsenic, carbon bisulphide and monoxide, anilin, copper, zinc, mercury, phosphorus, ergot, morphine, æther, sulphonmethane, sulphonethylmethane, etc. The condition may occur as a complication of the infectious diseases such as enteric fever, influenza, diphtheria, leprosy, measles, sepsis, etc., and here is due to the specific toxin of the infection.

Beri-beri is a particular form of neuritis and is probably caused by a specific organism.

Poisons formed in the body in certain constitutional states, e. g., diabetes mellitus, gout and purinæmic conditions, may cause neuritis and, finally, it may occur in the chronic wasting diseases, anæmia, tuberculosis, cancerous states and general malnutrition. The disease, except the form which is a sequela of diphtheritic infection, and that occurring with anterior poliomyelitis, is one of adult life and is seen most commonly between the ages of twenty and fifty years. The great majority of cases are the result of alcoholism and women seem particularly prone to this type of neuritis. Exposure to cold may act as a predisposing factor.

Pathology. The inflammation is usually of the parenchymatous type and the changes in the nerve substance are identical with those described on pages 786 and 787.

Symptoms. The onset of the disease may be acute or subacute. In the

acute form there are chilly sensations followed by a moderate rise of temperature—102° to 104° F. (38.8°–40° C.)—with general pains, malaise, etc. At times the onset may occur without febrile movement.

Sensory symptoms appear early; there is severe pain in the limbs, increased by movement or pressure; there is tenderness along the course of the affected nerves and there may be various paræsthesiæ, such as tingling, numbness, sensations of cold and girdle sensations about the limbs or body. Anæsthesia begins at the fingers or toes and extends symmetrically up the limbs.

Motor Symptoms. Following the disturbances of sensation muscular weakness appears which soon may develop into complete paralysis of the limbs so that the patient may become unable to move in bed; the extensors may be more severely affected than the flexors and in consequence, wrist and foot drop occur. Atrophy soon appears with diminution or loss of the deep reflexes. There may be ataxia, evidenced by inability to perform fine movements, and loss of muscular sense. There are no vesical or rectal disturbances.

Trophic Symptoms. These occur as a result of vaso-motor paralysis and there may be resulting œdema, glossiness of the skin, sweating, skin eruptions and roughened nails; bed sores are unlikely to develop.

The paralysis often does not affect all the nerves of a limb but is, as a rule, symmetrical.

The cranial nerves are at times affected and, as a result of their involvement, there may be facial paralysis, nystagmus or strabismus and disturbances of heart action due to inflammation of the vagus.

Mental disturbances such as disorders of memory, abnormalities of intellection and a mental condition known as Korsakoff's disease, characterized by a tendency to "pseudo-reminiscence" and to tell of imaginary adventures or experiences, may occur.

Alcoholic neuritis is usually rapid in onset and may be accompanied by mental symptoms such as delirium or delusions; the pain and anæsthesia are very marked and the paralysis may be total. In other patients the symptoms may be almost identical with those of locomotor ataxia (pseudo-tabes) but there is no pupillary disturbance and rectal and vesical control remain normal.

Lead neuritis may be ushered in by intestinal colic; there may be a lack of disturbance of sensation but the usual motor symptoms are present.

Arsenic neuritis is characterized by gastro-intestinal disturbances followed by paralysis, ataxia, numbness and atrophy, and but slight pain. A brownish pigmentation of the skin, chiefly on the extensor aspects of the limbs, is typical.

Carbon monoxide poisoning causes a neuritis evidenced chiefly by sensory symptoms; these are usually slight but last for a long time.

Diphtheritic neuritis is accompanied by marked paralysis with slight sensory

disturbance; ataxia may be present and the cranial nerves are often involved as shown by ocular paresis and difficulty in articulation and deglutition. Death may occur as a result of involvement of the phrenic nerve.

The prognosis. The usual course of the disease is slow but, as a rule, recovery finally takes place unless the nerves have been so profoundly affected that regeneration is impossible. In alcoholic neuritis the symptoms rapidly increase in severity for several weeks, remain stationary for two or three months and gradually subside, recovery ensuing usually within a year. In lead and arsenic neuritis the duration of the condition depends upon the amount of the poison in the system and the rapidity with which it is eliminated; recovery usually takes place in from four to six months. Diphtheritic neuritis is dangerous only on account of the possibility of involvement of the nerve control of the vital functions; failing this deplorable condition, recovery occurs in three or four months although, at times, the symptoms extend over a much longer period.

Either the sensory or the motor symptoms may begin to disappear first but, even if there are long periods during which there is no improvement, one should not despair; recovery is possible even after two years or more.

An unpleasant consequence of the disease is a tendency to contracture and deformity due to the unopposed action of unaffected muscles.

Treatment. This in certain measure depends upon the cause of the neuritis. In alcoholic neuritis the use of this substance should be stopped; in instances due to plumbism or arsenical poisoning a change of occupation may be necessary, although much may be accomplished in the way of prophylaxis of the former type by insisting upon thorough washing of the hands before eating, by the drinking of sulphuric acid lemonade made by adding five drops (0.33) of aromatic sulphuric acid to a wineglass (60.0) of water, and by keeping the bowels freely open with Epsom salts. The elimination of these poisons may be aided by the administration of potassium iodide, 15 to 30 grains (1.0–2.0) two or three times a day.

During the acute stage of the disease the patient should be kept at rest in bed and his food should be nutritious and easily digestible, the bowels should be kept open and the skin and kidneys active. The salicylates may be useful in mild cases and the pain may be controlled by the use of the various agents mentioned under the treatment of neuritis in general (p. 788).

Contractures and their resulting deformities should be prevented by keeping the limbs in proper position by the employment of bandages, splints or sand bags and the pressure of the bed clothing should not be allowed to increase any tendency to foot drop.

Gouty or purinæmic conditions should receive appropriate treatment and in anæmic states iron, arsenic, codliver oil and other tonics are useful.

In polyneuritis following the infectious diseases it is important that the

patient should be kept in bed until all heart weakness is past and, if there are manifest signs of cardiac disorder, he must be warned against any sudden movement, sitting up in bed or excitement, since undue strain may result fatally, death being due to heart failure. Here cardiac stimulants are often indicated as well as the ordinary treatment of the condition.

After the acute stage is past phosphorus and strychnine are indicated; it is often wise to alternate the latter drug with arsenic giving the strychnine in doses of $\frac{1}{40}$ of a grain (0.0015) three times a day for a week, then the arsenic—arsenic trioxide gr. $\frac{1}{20}$ (0.003)—for a week, and so on. The nutrition of the affected muscles and nerves now should be improved by the employment of faradism, a rapidly interrupted current being used upon the nerves and one slowly interrupted upon the muscles. Galvanism is also useful and warm baths at body temperature for a half hour several times daily, as well as massage and passive movements, in moderation, should be employed.

Contractures and deformities resulting from multiple neuritis may necessitate the employment of orthopædic apparatus or of surgical measures such as tenotomy or tendon transplantation.

SCIATICA.

This condition is the result either of a neuralgia or more usually an inflammation of the sciatic nerve or its sheath.

Ætiology. Sciatica occurs as a rule only in adults and is most often observed between the ages of thirty and fifty years, although it appears at times in the third decade of life as well as in individuals over fifty. It affects men much more often than women. The poisons of chronic rheumatism, gout and, more rarely, of syphilis, seem to predispose to the disease, while as exciting causes exposure to cold and wet and to draughts, particularly after exertion, may be mentioned. Mechanical pressure upon the nerve by intra-pelvic tumors and accumulations of fæces, and inflammatory foci either within or outside the pelvis may cause sciatica.

Pathology. The morbid anatomy of this condition is identical with that described in connection with other forms of neuritis.

Symptoms. Of these pain in the posterior part of the thigh is the most frequent. This pain may extend upward as far as the sciatic notch through which the nerve emerges from the pelvis, and along the course of the nerve through the popliteal space, down the leg behind the internal malleolus and upon the dorsum of the foot. The pain may be more or less distinctly localized in the course of the nerve and throughout this extent tenderness may be present; pressure over the sciatic notch is almost pathognomonic. Positions of the leg which stretch the nerve, particularly flexion of the thigh on the

pelvis while the leg is extended at the knee, increase the pain. In character the pain is like that of inflammations of other nerves and the onset of this symptom may be gradual or sudden. The reaction of degeneration is seldom observed but the patellar reflex may be absent. Vaso-motor and trophic manifestations are rare.

The prognosis. The course of the disease is chronic and often obstinate, yet recovery is the rule. Life is not endangered.

Treatment. Rectal and pelvic examinations often throw light upon the causation of the condition and, in such instances removal of the cause is of course indicated. Defects of the spinal column are often responsible also and here relief may be obtained by orthopædic treatment. Gouty, rheumatic and syphilitic instances should receive treatment appropriate to these conditions. The acuity of the attack should be treated by rest in bed and the application of a Thomas splint extending from the axilla to the heel. Numerous local applications are recommended most of them counter-irritant. Of these perhaps the best is the thermo- or electric cautery; it should be applied very lightly so that a minute after its use the skin shall show no trace; every two days is often enough to employ this agent. Other counter-irritants have a field of usefulness; of these leeches, flaxseed poultices, collodium cantharidatum or a mixture containing 16 parts of strong spirit of ammonia, spirit of rosemary 12 parts, spirit of camphor 4 parts, may be employed as a vesicant over the painful points; cold applications, the æther or ethyl chloride spray, bandaging with a mixture of sulphur and menthol, and ichthyol may be prescribed.

The injection of various substances into the painful area or into the sheath of the nerve is often efficacious. Strychnine sulphate or nitrate, gr. $\frac{1}{60}$ – $\frac{1}{20}$ (0.001 to 0.003) injected into the buttocks twice a day is an excellent remedy. The dose may be gradually increased to gr. $\frac{1}{10}$ (0.006) but the patient must be carefully watched for increased muscular excitability. In injecting drugs into the nerve it is best to induce anæsthesia by a cocaine injection (gr. $\frac{1}{8}$–$\frac{1}{4}$—0.008–0.016) before the procedure. The intra-neural injection may consist of sterile water or chloroform.

Acupuncture is a drastic method of treatment but may afford relief. Its technique consists in plunging several needles into the painful area for a depth of about two inches and allowing them to remain for about a quarter of an hour.

Of internal analgesics, antipyrine, acetphenetidine, salipyrine, and acetanilide in the usual doses may be tried. If there is tendency to heart weakness it is always wise to add to each dose of these drugs 2 or 3 grains (0.13–0.2) of caffeine sodiobenzoate. Codeine may also be employed and at times the pains may be so severe that the hypodermatic administration of morphine becomes absolutely necessary; it should, however, be given only

as a last resort on account of the ease with which patients become habituated to its use.

For the disease itself aconitine, gr. $\frac{1}{400}$ (0.00015) with $\frac{1}{60}$ of a grain (0.001) of strychnine may prove effectual. These should be given every six hours at first, but the intervals should be gradually shortened until by the fifth day of the treatment the patient is receiving them every two hours. He must be carefully watched for signs of heart weakness and should be told to warn the physician when tingling and numbness of the pharynx are noticed. Gelsemium to the physiological limit may also be employed. Oil of turpentine in doses of 15 drops (1.0) three times a day with oil of wintergreen has been considered a specific, but is of rather doubtful value.

In rheumatic patients sodium or potassium salicylate should be given to the physiological limit; colchicum may act favorably also and should likewise be administered to the limit of tolerance. Ichthyol internally in small doses may prove beneficial, and blue mass in doses of 1 grain (0.065) twice a day has been recommended in cases where the inflammation is acute. If all other drugs are without effect potassium iodide may be given.

Massage and electricity may prove useful in chronic instances especially if atrophy is present. The galvanic current should be used, one electrode being applied at the point of emergence of the nerve from the pelvis and the other moved along the course of the nerve.

Spa treatment with warm or mud baths often acts well but is by no means certain to do so.

Nerve stretching may be employed as a last resort. The technique consists in laying the patient upon his back and fixing him in this position, the operator, with one hand upon the patient's knee so that this joint may remain extended, flexes the thigh upon the pelvis. Too much force should not be exerted. The operation of dissecting the sheath from the nerve for a distance of a few inches has been employed. These two last procedures are calculated to break adhesions between the nerve and its sheath.

DISEASES OF THE CRANIAL NERVES.

DISEASES OF THE FIRST PAIR: THE OLFACTORY NERVES.

The functions of the olfactory nerves may be disordered at their points of origin, at any point in their course through the cerebral tissue, in their trunks, in the bulb or in their terminal distribution in the mucous membrane lining the nose.

Pathology. The disturbances may be the result of brain tumors involving their course, of congenital abnormality, or atrophy. Affections at the distri-

bution of the nerves in the nasal lining occur as a result of chronic nasal inflammations or new growths. Hysterical disorders of smell are often observed and changes in the function of the nerves which have no apparent pathological basis, are seen after head injuries and epilepsy.

Symptoms. These consist of disorders of the sense of smell: *a. Anosmia* or loss of the sense of smell. This condition is caused most frequently by affections of the nerves in the nasal mucous membrane due to nasal catarrh or polypi; it occurs also in lesions of the olfactory bulbs or tracts, such as may result from injuries, tumors, inflammations, or atrophy of the nerves, such as may occur in tabes; it is also seen in lesions or congenital defects of the olfactory centers.

b. Hyperosmia or increased acuity of smell. This is chiefly a hysterical manifestation occurring most often in nervous women. Patients have been observed who could recognize persons by their odor alone.

c. Parosmia or hallucinations of smell. These are seen in the insane and in epileptics, the epileptic aura in which a distinctive odor is perceived being an example. This disturbance may occur also as a result of cerebral tumor or injury. The patient may have so perverted a sense of smell as to consider two totally different odors as alike or attribute an odor to a certain substance entirely different from its actual odor.

In testing the sense of smell the essential oils such as those of peppermint, anise, cloves, etc., are used, and in the further diagnosis of the condition thorough rhinological examination should never be omitted.

Treatment consists in the proper management of the intranasal lesion if such is present; otherwise little can be done and the normal sense of smell is seldom restored.

DISEASES OF THE SECOND PAIR: THE OPTIC NERVES.

The disease may occur in the optic tract, in the chiasm, in the optic nerve itself or in the retina. Lesions of the optic nerves may be caused by new growths, hæmorrhages, meningitis, abscesses, syphilitic disease, etc. Disorders of the optic tract may exist independently of retinal change but when of long standing, atrophy of the retina may occur as a consequence. Chiasmal lesions may be caused by tumors of the base, hydrocephalus, basilar meningitis and acromegaly. Such lesions usually involve that part of the chiasm through which the decussating fibres pass and result in blindness of the nasal halves of the retinæ. Lesions affecting the direct fibres of one side produce blindness in one eye and of the nasal half of the retina of the other. Involvement of the entire chiasm causes total loss of vision.

Lesions of one tract, for instance, the left, cause blindness of the temporal half of the left retina and of the nasal half of the right, a condition termed

homonymous hemianopsia. The hemianopsia may be partial or entire, depending upon the extent of the lesion, and the vision of the other halves of each retina may or may not be impaired. Disturbances of the tract anterior to the anterior corpora quadrigemina often involve other cranial nerves and result in optic paralyses, sensory disorders in the face or affect the special senses. In determining the site of the lesion in hemianopia Wernicke's test is of much value. This is based upon the assumption that the pupillary reflex centers are situated in or anterior to the anterior corpora quadrigemina. If the lesion is behind this situation the pupil will contract when light is thrown upon the blind portion of the retina. If the pupil does respond to light it is probable that the lesion is a central one. In affections of the optic thalamus or internal capsule hemiplegia or hemianæsthesia are likely to accompany the ocular disturbance; lesions of the right motor tract, for instance with left hemiplegia, being associated with, when there is involvement of the optic tract in the internal capsule, disturbance of sight characterized by inability to see objects in the left field of vision. Conditions of mind blindness—ability to see objects but failure to recognize them—and of aphasia may also occur.

There are two principal lesions of the optic nerve, these are *optic neuritis* and *optic atrophy*.

Optic neuritis, papillitis or choked disk begins as a blurring of the edges and congestion and swelling of the optic disk, later the margin of the disk becomes indistinguishable, the change taking place first upon its nasal side. Indirect examination reveals a disk red or reddish gray in color, while direct inspection shows a striated appearance, the striæ radiating from the center outward. The veins are dilated while the arteries remain normal in size or are diminished. The retina also may become affected, a neuro-retinitis resulting. Hæmorrhages may take place.

The condition is most usually the result of some intra-cranial lesion, particularly tumor. It also occurs in abscess, meningitis, nephritis, anæmia, multiple sclerosis and plumbism and idiopathically.

The milder types of the disease may cause no disturbance of sight, in severer cases the visual function is impaired and may be wholly lost. If the inflammation subsides the symptoms usually become less marked, but the condition may result in permanent blindness.

Optic atrophy occurs primarily in an hereditary type, appearing in the males of a family after puberty; it occurs also in spinal diseases, particularly locomotor ataxia, in diabetic disease, plumbism and alcoholism, after exposure, and in the acute infectious diseases.

It develops secondarily in multiple sclerosis and other brain diseases and as a consequence of optic neuritis.

In the primary type ophthalmoscopic examination reveals a grayish disk of well-defined outline and a practically normal condition of the arteries, while

in the secondary form the disk is whitish and opaque, its margin is irregular and the arteries are shrunken.

The vision is disturbed in a degree varying with the severity of the lesion, it becomes less acute, the field of vision is diminished and color sense is changed. In the primary type blindness usually results; in mild instances of the secondary variety recovery may occur but more often the sight is permanently impaired.

The treatment is that of the cause of the condition.

Lesions of the retina may be either organic or functional. Of the former type two varieties should be described.

Hæmorrhage into the retina occurs in nephritis, in chronic gouty conditions, syphilis, septicæmia, anæmia, leucæmia and purpura hæmorrhagica. The extravasations of blood take place in the nerve fibre layer and are of greater or less extent and pial hæmorrhages may co-exist. The hæmorrhagic spot is at first bright red, then darker, and finally, as the blood pigment becomes absorbed, light in color; white areas may be visible, due to exudates, spots of fatty degeneration or consequent sclerosis and, in the hæmorrhages of septicæmia, to collections of white blood cells.

Retinitis occurs in malarial states, plumbism and in the same conditions as does retinal hæmorrhage. The most important type is that occurring in chronic nephritis. The ophthalmoscopic appearance is characterized by white areas differing in size and distribution. These are the result of hæmorrhages and sclerotic processes. Arteriosclerosis is always seen in patients exhibiting this affection. According to Gowers three forms are distinguishable.

a. The degenerative with retinal changes but with little alteration of the disk. This is the most common type.

b. The inflammatory with marked swelling of the retina and obscuration of the disk.

c. The hæmorrhagic with numerous hæmorrhages and only slight inflammation.

At times the inflammatory changes in the optic nerve are more marked than those in the retina which may cause doubt as to whether the lesion is the result of renal or intra-cranial disease.

Syphilitic retinitis is rare; when congenital it usually occurs in pigmentary form (*retinitis pigmentosa*).

Anæmic retinitis occurs especially in the pernicious type of the disease. Sudden blindness in one or both eyes may take place after profuse hæmorrhage or the process may take several days for its completion. The loss of sight may prove permanent. Neuro-retinitis may also occur.

Chronic malaria with consequent anæmia may be complicated by retinitis.

Leucæmic retinitis is characterized by an enlarged and distended condition of the retinal veins, there may be hæmorrhage and yellowish or white spots.

Functional retinal disturbance or amaurosis occurs as a result of a variety

of causes. Of these *uræmic poisoning* is the most frequent. It may appear independently of other uræmic symptoms or before or after convulsions due to the same cause. Its onset is usually sudden and the blindness lasts but a few days. The ophthalmoscopic appearance is unchanged. Analogous to uræmic amaurosis are the types of this condition due to quinine, plumbism, alcoholism, and especially to methyl alcohol poisoning.

Tobacco amaurosis affects the center of the visual field particularly and is usually of gradual development. The fundus may remain normal in appearance or there may be congestion of the disks. Unless the use of the drug is discontinued organic changes and atrophy of the disk may result. A central scotoma for red and green is always present.

Hysterical amaurosis may occur but there is more often impairment of vision only; the blindness may affect one eye only. In *night blindness* or *nyctalopia* vision is clear by day or strong artificial light while the reverse is true in the shade or in twilight. In *hemeralopia*, the opposite condition obtains. These are rare states and may occur epidemically.

Retinal hyperæsthesia is not often observed in retinal lesions but may occur in hysterical patients.

DISEASES OF THE MOTOR NERVES OF THE EYEBALL: THE THIRD, FOURTH AND SIXTH PAIRS.

The third nerve, the *oculomotor*, supplies the levator palpebræ superioris, the superior and inferior recti, the internal rectus, the inferior oblique, the sphincter of the iris and the ciliary muscle; the fourth nerve, the trochlear, the superior oblique, and the sixth nerve, the abducens, the external rectus.

Paralyses or spasms of the third nerve occur as a result of inflammation of the nerve, as a result of pressure from the products of neighboring inflammation—as in meningitis—from tumors, syphilitic and otherwise, and due to lesions at the origin of the nerve upon the floor of the aqueduct of Sylvius. In the latter case there is accompanying disturbance of the other motor nerves of the eye. Paralysis of this nerve occurs also in rheumatic conditions, secondary to the infectious diseases, especially diphtheria, after exposure to cold, in hysteric conditions and in locomotor ataxia. Its symptoms are ptosis, pupillary dilatation and entire loss of accommodation, double vision and divergent strabismus.

Cycloplegia is a result of paralysis of the ciliary muscle and gives rise to loss of the power of accommodation. Objects at a distance are seen clearly while those nearby are indistinct. When in both eyes it is usually due to lesion at the origin of the nerve. It is seen early in diphtheritic paralysis and occurs also in locomotor ataxia. It may be corrected by glasses.

Iridoplegia or paralysis of the iris occurs in locomotor ataxia, brain tumors,

etc. In the accommodative form the pupil does not alter in size during accommodation. In the reflex variety—the "Argyll-Robertson pupil"—the loss of accommodation to light may be tested by directing the patient to look at a distant object, then a bright light is suddenly flashed into the eye. If this affection is present the pupil will fail to contract. In skin iridoplegia the cutaneous reflex is lost and a reflex dilatation of the pupil takes place if the skin of the neck, which is supplied by the cervical sympathetic nerve, is irritated mechanically or electrically.

The condition of *anisocoria*, unequal pupils, may be observed in health and also as a symptom of locomotor ataxia and paresis.

Spasmodic contraction of the muscles supplied by the third nerve may occur in migraine, hysteria, meningitis, congenital and other cerebral lesions and in albinos. The spasm usually is in the form of a rhythmic movement of the eyeball from side to side—nystagmus—more rarely is the motion rotary or vertical.

The fourth nerve, the *trochlear*, is subject to abnormal conditions analogous to those described above and under the same conditions. Paralysis of this structure is manifested by loss of power in the superior oblique muscle and consequent convergent strabismus. Here there is impairment of ability to move the eyeball downward and inward. This defect is frequently not noticeable. The head is inclined forward and toward the unaffected side and diplopia is present when the vision is directed downward.

The sixth nerve, the *abducens*, may be paralyzed as a result of lesions similar to those affecting the third and fourth nerves. The paralysis produces internal strabismus since the only muscle supplied by this nerve is the external rectus. The eyeball cannot be turned so as to look outward. Double vision may be present when the patient looks toward the paralyzed side. In affections of the nucleus of origin of this nerve, conjugate deviation of both eyes away from the side of the lesion, is observed due to the fact that the nucleus of the third nerve is connected with that of the sixth, consequently in lesions of the latter the internal rectus is paralyzed in associated movements, although the nucleus of the third nerve, which supplies this muscle, is not affected; there is no disturbance of the power of convergence.

General paralysis of all the motor nerves of the eye or **ophthalmoplegia** may be caused by disease of the nuclei of origin of the third, fourth, and fifth nerves, by tumors and the pressure of inflammatory exudates, and may occur in general paresis, locomotor ataxia and progressive muscular atrophy. It occurs in two forms, *ophthalmoplegia externa* and *ophthalmoplegia interna*. The two types may co-exist—*total ophthalmoplegia*. In the external type the eyeball is immobile, ptosis is present and there may be slight exophthalmos; with it there may be optic nerve atrophy and involvement of other cranial nerves.

In the internal type power of accommodation and pupillary reaction are lost. Ophthalmoplegia is usually a chronic condition but rarely an acute form is observed, the onset of which may be rapid; accompanying this type are cerebral disturbance and hæmorrhagic degeneration of the nuclei of origin of the motor nerves of the eyeball.

Treatment of the ocular palsies. This, to a great extent, depends upon the cause. In acute instances the pain may be relieved by hot compresses, mild counter-irritation and the application of leeches to the temples. Syphilitic instances and those occurring in the course of locomotor ataxia should receive mercury and potassium iodide in large doses. Strychnine, hypodermatically in considerable doses, $\frac{1}{80}$ to $\frac{1}{20}$ of a grain (0.002–0.003), arsenic and iron are also useful; the three may be given in combination. In the chronic type the use of electricity is recommended. If galvanism is employed the anode is applied to the forehead and the cathode is moved along the margin of the orbit over the affected muscles; if the faradic current is used the cathode is not moved. For the ptosis the current is applied over the third nerve. Double vision may be relieved by the use of prisms, or if it is impossible of correction, both it and the dizziness may be obviated by wearing an opaque glass over the affected eye.

DISEASES OF THE FIFTH PAIR: THE TRIGEMINAL NERVES.

Lesions of the fifth nerve result from disease of the pons, especially hæmorrhage or sclerosis; injury or disease at the base of the cranium, such as bone caries, meningitis, syphilitic or other new growths; pressure upon the branches of the nerve from tumors or aneurysms in the cavernous sinus or from lesions in the spheno-maxillary fossa. Primary inflammation of the nerve is rare.

Sensory symptoms may be caused by hysteria and disturbances of taste by the influence of disturbances of the facial nerve upon the chorda tympani.

Motor disturbances. These consist of paralysis and spasm. The former involves the temporal, masseter and pterygoid muscles and is characterized by difficulty in mastication; if both sides are involved this act is impossible and the lower jaw hangs down. If only one side is affected the jaw is displaced toward the affected side when open.

Spasm occurs with muscular cramp, in tetanus (lockjaw or trismus), in tetany, and in meningitis. It is seen also in hysteria and as a result of diseases of the mouth, jaw or teeth. The jaws are tightly shut and the contraction of the muscles of chewing may be painful. Clonic spasm (chattering teeth) may occur in chorea, hysteria and without assignable cause.

Disturbances of taste resulting from lesions of the fifth nerve consist in the partial or complete loss of this sense over the anterior two-thirds of the tongue

as stated by some, although it would seem from the fact that many trigeminal neurectomies do not result in gustatory disturbance that the nerve fibres from this part of the tongue may reach the brain by more than one route.

Sensory disorders are characterized by loss of sensation of half the face, conjunctiva, cornea, mucous membrane of the lips, tongue, hard palate and nose of the same side. Smell is rendered less acute as a result of drying of the nasal mucous membrane; taste may be disturbed. Painful tingling may precede the anæsthesia. Trophic disturbances occur such as diminution of the saliva, the lachrymal, buccal and nasal secretions and the teeth may become loose. Herpes with pain may develop over the course of the nerve and there may be facial œdema. The diagnosis is simple. Taste may be tested by touching the tongue on either side with a weak acid solution and comparing the effect, motility, by directing the patient to bite a piece of soft wood, and sensation, by the usual methods.

Treatment should be directed to the removal of the causative factor. Syphilitic cases should receive appropriate treatment. The teeth should be put in proper order, nasal and aural examinations should be made and any existing abnormality corrected. Anæsthetic parts should be protected against injury and irritation. The pain may be relieved by the means described under the section on the treatment of neuritis (p. 788) and the local applications there mentioned are also useful. Morphine should be employed as a last resort only.

The use of the faradic current and of massage is indicated in order to restore the muscular tone, and attention should be given to the general health of the patient.

DISEASES OF THE SEVENTH PAIR: THE FACIAL NERVES.

Disease of the facial nerve may result in paralysis or spasm.

Paralysis (Bell's palsy, monoplegia facialis or mimetic facial paralysis) may be caused by lesions in the cortex, in the brain between the cortex and the nucleus of origin of the nerve, in this nucleus and in the nerve itself. The cortial lesions occur with hemiplegia due to cerebral hæmorrhage, inflammations and tumors; those of the nucleus result from like causes and from the toxins of infectious diseases, especially diphtheria, and lesions of the nerve itself may be caused by exposure, extension of middle ear or temporal bone disease, new growths, injury at the base of the brain, meningitis or syphilitic infiltration in the same situation. The nerve may be affected in lesions of the medulla oblongata, and as a result of traumatism during birth.

Symptoms. These differ with the site of the lesion causing the paralysis. The onset of the condition is usually sudden but at times prodromal symptoms such as disorders of taste, facial and aural pain and tinnitus, are noticed.

As a rule the paralysis is one-sided, rarely is it bilateral. The face is drawn toward the sound side, except after contracture, in cases of long standing. The affected side of the face is immobile and smooth, the forehead loses its wrinkles, the facial expression is lost, the eye remains open even during sleep, the corner of the mouth drops and there is dribbling of saliva, whistling is impossible and the labials are pronounced with difficulty; the tongue is not deviated and during mastication the food collects in the paralyzed cheek. The corneal reflexes are lost, the eye waters and conjunctivitis is frequent. Winking is impossible if the paralysis is complete. In peripheral paralysis the eye may roll upward and outward (Bordier-Fränkel's sign) Drinking is difficult on account of the inability of the patient to approximate his lips to the glass.

In lesions of the nerve between its union with the chorda tympani and the geniculate ganglion, taste is lost in the anterior two-thirds of the tongue on the affected side. The saliva is diminished and the tactile sense of the tongue may be impaired. Auditory disturbance may occur due to concurrent aural lesions but the hearing, especially for low notes, may be rendered more acute by paralysis of the stapedius muscle. Herpes may be present.

The electric reaction in mild instances may remain normal in the paralyzed muscles, and here recovery within a few weeks is usual. In more severe instances the electric reaction in the nerves is diminished while in the nerves, after a few weeks, the reaction to direct galvanic stimulation is increased, the anodal closure contraction exceeding the cathodal, and the response to stimulation is delayed. Here recovery is less rapid but is likely to be complete in a month or two. In very marked instances complete reaction of degeneration is present, the course of the disease is much more protracted and may last for a year or more. Relapses may occur. When brain tumor or necrosis of the petrous portion of the temporal bone are ætiological factors the paralysis may be permanent.

Treatment should be directed at the cause of the condition. In syphilitic cases the administration of the iodides in gradually increasing doses is indicated. If the paralysis is due to lesions of the middle ear these should receive appropriate treatment. When pressure is responsible its cause should be removed if possible. When the disease is the result of exposure the salicylates in large doses should be given and warm compresses, wet or dry, should be applied to the face; later counter-irritation by means of the thermo-cautery or vesicants is useful. The hypodermatic exhibition of strychnine sulphate in doses of $\frac{1}{30}$ to $\frac{1}{20}$ of a grain (0.002–0.003) daily or every two days may prove useful and salicin, 20 to 30 grains (1.3–2.0) three times a day or sodium salicylate in similar dosage may be prescribed with benefit. In the later stages electricity should be employed; galvanism is to be preferred; the current should not be strong and it may be applied over the affected muscles and also administered by placing the poles alternately below and in front of the ear,

and interrupting the current about every fifteen or twenty seconds. Massage of the facial muscles may also be employed.

Nerve anastomosis is indicated in patents in whom the continuity of the nerve has been destroyed by injury or by disease, after electricity has been faithfully used for several months without sign of return of function. The anastomosis is made with the hypoglossal or the spinal accessory nerve and while complete recovery may not take place, the operation is likely to restore the power of the affected muscles to a considerable extent and to greatly mitigate the deformity.

Spasm. Facial spasm, mimic spasm or convulsive tic, may be unilateral or bilateral and consists of a clonic contraction of one or more of the muscles innervated by the seventh nerve. *Habit spasm* is an analogous affection, occurring usually in children as a result of "making faces."

The cause is indefinite, but the condition has been considered as due to exposure, to pressure at the base of the brain from tumor or aneurysm or to a lesion of the facial center in the cerebral cortex. Reflex instances also occur due to decayed teeth, intestinal worms or sexual disorders. The condition usually involves only one or two branches of the nerve, especially those supplying the orbicularis muscle (*blepharospasm*) and the neighboring muscles. Here there is twitching of the eyelid often with accompanying spasm of the muscles of the side of the face. The angle of the mouth may be twitched downward and the contractions may also involve the muscles of mastication, the tongue and the platysma. The spasms occur spontaneously, are not painful, and last for shorter or longer periods. They may be so continuous that, while the patient is awake, his face exhibits constant twitchings. The contractions are increased by physical or mental fatigue and by undue emotion. Pressure over various points along the course of the nerve may elicit pain.

A tonic form of the disorder may occur with paralysis or from cold or, more often reflexly, from some disturbance of the eye.

The prognosis of facial spasm is not favorable although intermissions may be observed.

Treatment consists in removing all possible causes of reflex irritation, especially in the eyes and teeth. Counter-irritation may be applied along the course of the nerve and especially over the points which are tender upon pressure. Here the Paquelin cautery and vesicants may be useful. Freezing of the affected cheek with the ethyl chloride, rhigolene or æther spray for a few moments daily may prove beneficial, temporarily at least. Hypodermatic injections of strychnine have been recommended and such drugs as potassium iodide, arsenic, iron, atropine and curare may be employed but it is doubtful if they will cause improvement. Nerve sedatives, the bromides, hyoscyamus or codeine may be given.

Electricity in the form of galvanism may be employed, the anode being

placed over the tender points or along the nerve trunk. Reflex instances may be benefited by applying the positive pole to the nuchal region while the negative pole is held in the hand.

Surgical interference consisting of division of the nerve and making an anastomosis between it and the eleventh nerve, has been advocated. Nerve stretching may afford relief although this may be but transient, the spasm recurring when the paralytic effect of the stretching has passed.

DISEASES OF THE EIGHTH PAIR: THE AUDITORY NERVES.

Affections of the eighth nerve may result from lesions in any part of its course. Disease at its nucleus of origin is rare; in its course it is subject to involvement in fractures, tumors, inflammations or hæmorrhages and inflammation of the nerve itself occurs as a complication of the infectious diseases, locomotor ataxia and cerebrospinal meningitis.

The two branches of the nerve should be considered separately since the cochlear is concerned in audition and the vestibular in coördination.

The Cochlear Nerve. Lesions such as tumor at the cortical auditory center in the temporo-sphenoidal lobe, when on the left side, cause word deafness; those involving the course of the cochlear nerve from the auditory center to its origin result in true deafness.

Pressure upon the nerve at the base of the brain from tumors, aneurysms, inflammatory exudates, hæmorrhage, or injuries, and degeneration of the nerve such as occurs in locomotor ataxia, may produce lesions of the nerve in its course. Deafness also may be caused by the effects of epidemic cerebrospinal meningitis upon the nerve.

Affections of the internal ear, primary or as a result of middle ear lesions, are the most frequent causes of disorders of the auditory nerve.

The symptoms produced by lesions of the cochlear branch are *a*, auditory hyperæsthesia; *b*, irritation of the auditory nerve; *c*, nervous deafness.

Auditory hyperæsthesia (hyperacusis) is a condition in which sounds inaudible to the normal individual become audible and ordinary sounds are heard with an increased intensity. *Dysæsthesia* (dysacusis) is a condition characterized by discomfort upon hearing ordinary sounds, as in headache when a sound, such as would have no effect under normal conditions, increases the pain. These affections may occur in hysterical conditions and in cerebral disease.

Treatment should be directed at the cause of the condition and the unpleasant symptoms may be controlled by sedatives such as the bromides and valerian.

Auditory Irritation (tinnitus aurium). Under the general term tinnitus are classified all forms of abnormal subjective sensation to which the ear is subject, including ringing, buzzing, hissing, roaring sounds, etc. Even

the sound of voices may be heard. The sounds vary from those hardly noticeable to those that cause profound discomfort. *Bruits* may be heard synchronous with the cardiac systole and may be audible through the stethoscope applied behind the ear, clicking sounds, at times perceptible to the patient's companions, may be caused by spasm of the palate muscles. The auditory aura, occurring sometimes in epilepsy, is a form of this trouble. The misery induced by such conditions has been known to result in suicide.

The ætiology may be difficult to discover. The ear should always be examined for accumulations of cerumen and for middle ear disease. Gouty, anæmic and neurasthenic conditions are often responsible for tinnitus, as is the administration of quinine or salicylic acid in large doses.

Treatment consists in measures calculated to relieve any existing aural lesion, such as the removal of impacted cerumen, the exhibition of the salicylates, the iodides and colchicium in rheumatic and gouty instances and of iron and arsenic when anæmia seems responsible. Neurasthenia should receive appropriate treatment and the patient's nutrition and general hygiene should be considered.

The application of vesicants or even of the actual cautery behind the ear, and the bromides, either alone or in connection with small doses of belladonna are said to be useful. Glyceryl nitrate in ascending doses until the physiological effect, as evidenced by feeling of fulness in the head and dizziness is noted, is also recommended.

Nervous deafness is evidenced by diminution of the ability to hear sounds when conducted by the air, while sounds conducted through the temporal bone are audible. The test consists in holding the tuning fork near the ear, then placing it in contact with the temporal bone. If it is not heard in the latter case the loss of the power of hearing is not due to nerve deafness.

Treatment is likely to be of little avail. The otologist should be consulted and a careful examination of the organ made; the management of the condition belongs rather to the domain of the specialist than to that of the physician. Antisyphilitic treatment should be given when indicated and electricity and mild counter-irritation have a field of usefulness.

The Vestibular Nerve. Disturbances of this structure are evidenced by vertigo, nystagmus and disorders in the function of coördination in the head, neck, and eyes.

Ménière's disease or *aural vertigo* is a condition resulting from a lesion of the labyrinth. Its pathology is indefinite; it occurs much more frequently in men than in women and is most often observed between the ages of thirty and sixty years. Exposure, syphilis and gout have been considered ætiological factors and the degeneration occurring in such affections as locomotor ataxia and that of senility, as well as vaso-motor disturbances of the labyrinthine vessels, seem to have influence in its causation.

Symptoms. The onset of a paroxysm is usually sudden and may occur without assignable cause or be induced by coughing or sneezing. Between the attacks the patient may suffer from slight dizziness. The paroxysm is characterized by sudden buzzing noises in the ears and marked vertigo, in which the patient feels as if he were staggering or falling, the surrounding objects may seem to be turning about and he may grasp at stationary objects to prevent himself from falling or may lose consciousness for a few seconds. After a moment or two the dizziness passes, the patient being left faint, pale and nauseated with the face bathed in clammy perspiration. Aural symptoms such as tinnitus and deafness in one or both ears may occur and double vision or nystagmus may be coincident. The deafness is never complete, is of nervous type and the tinnitus is throbbing or roaring in character.

The paroxysms appear at intervals varying from a few days to a few weeks or even months.

The prognosis depends upon the cause. If this can be eliminated recovery is possible and at any rate improvement may be expected. In less favorable instances deafness results, which when complete is unaccompanied by dizziness.

The disease should not be confounded with *epidemic paralytic vertigo* (Gerlier's disease or kubisagari)—see p. 218—or with gastric vertigo, which is not accompanied with deafness.

Treatment consists in relieving the cause of the condition in so far as possible.

The eyes should always be examined for errors of refraction, correction of which may afford relief. Gouty patients should receive the salicylates, colchicum and the iodides; the first of these should not be given in sufficient dosage to induce tinnitus. Syphilitic patients should receive appropriate medication. When contraction of the general arterial system is present glyceryl nitrate or potassium iodide is indicated. Potassium bromide in doses of 15 to 30 grains (1.0–2.0) three times a day may be employed and Charcot has recommended the administration of quinine, beginning with moderate doses and gradually increasing them until cinchonism is produced.

Counter-irritation behind the ears in the form of blisters may prove temporarily beneficial.

DISEASES OF THE NINTH PAIR: THE GLOSSOPHARYNGEAL NERVES.

Branches from this pair of nerves supply sensory fibres to the upper part of the pharynx, the tonsils and soft palate, innervate the stylopharyngeus and middle constrictor of the pharynx and send taste fibres to the palate and posterior third of the tongue.

Lesions of the glossopharyngeal nerve result from tumors, meningitis and

degenerative processes; the nerve is seldom affected separately because of its communications with others of the cranial nerves

The symptoms of disturbance of the functions of this nerve are anæsthesia of the parts supplied by its sensory fibres, paralysis of the stylopharyngeus and middle pharyngeal constrictor, as evidenced by difficulty in swallowing, and gustatory disorders of the posterior third of the tongue and the palate.

Loss of taste sense—*ageusia*—results from disorder of the end organs in the mucous membrane of the tongue caused by the habitual use of strong condiments, such as pepper, or of irritating substances, such as tobacco; it also occurs in the dry tongue of febrile disease and the coated tongue observed in alimentary disturbances. Ageusia is a symptom of affections of the lingual branch of the fifth nerve, of the trunk of the fifth before it leaves the skull, of the seventh nerve between its union with the chorda tympani and the geniculate ganglion, and of certain cerebral lesions.

Perversion of taste sense (*parageusia*) is met but rarely and then as a symptom of hysteria or insanity. Subjective sensations of taste also occur in the insane and as an epileptic aura.

The sense of taste is tested by causing the patient to close his eyes and applying such substances as quinine, sugar solution, salt solution and vinegar to the anterior and posterior parts of the tongue. A feeble galvanic current gives a metallic taste and is a useful test. It is important that the test should be decided while the tongue is protruded.

DISEASES OF THE TENTH PAIR: THE PNEUMOGASTRIC OR VAGUS NERVES.

The extensive distribution of this pair of nerves renders them liable to a variety of disturbances. Their nuclei of origin in the floor of the fourth ventricle may be involved in bulbar palsy, they may be subjected to pressure in meningitis, syphilitic or other new growths, abscess, aneurysms or hæmorrhages. Their branches inside the skull are subject to pressure from various intra-cranial lesions; extra-cranial branches are subject to traumatism, to pressure from inflammatory processes, tumors and aneurysm, and may be involved in true neuritis.

The pharyngeal branches may be paralyzed in bulbar paralysis or in neuritis, especially that resulting from diphtheria. If but one side is affected the disturbance of swallowing is but slight; in involvement of both sides deglutition is attended with difficulty and liquids may regurgitate from the nostrils.

Spasm of the muscles of deglutition occurs in hysteria and in true and pseudo-hydrophobia.

The laryngeal branches. The laryngeal paralyses occurring in vagus lesions are of several types: *Unilateral abductor paralysis* is most frequently

caused by aneurysm, particularly of the arch of the aorta, since the recurrent laryngeal nerve of the left side passes around this structure. The nerve of the right side may be pressed upon by pleural thickenings.

In this condition the voice is hoarse or brassy and there may be slight dyspnœa. The paralyzed cord is seen immovable near the mid-line of the larynx.

Bilateral abductor paralysis is met in bulbar paralysis and locomotor ataxia, in hysteria, as a result of intra-laryngeal inflammations and degenerations, as well as of pressure upon both recurrent laryngeal nerves. The symptoms are inspiratory stridor and dyspnœa. The voice is unaffected and cough is absent. The dyspnœa is due to the close approximation of the vocal cords during inspiration and may necessitate intubation or tracheotomy. Laryngoscopic examination reveals the vocal cords in close proximity to one another.

Adductor, phonic or hysterical paralysis is seen in hysteria, in catarrhal laryngitis and as a result of over-use of the voice and is an affection of the crico-arytenoid and arytenoid muscles themselves. Examination reveals an inability to approximate the vocal cords on attempt at phonation.

The table given below (Gowers) will be found useful in differentiating the various types of laryngeal paralysis.

SYMPTOMS.	SIGNS.	LESION.
No voice; no cough; stridor only on deep inspiration.	Both cords moderately abducted and motionless.	Total bilateral palsy.
Voice low-pitched and hoarse; no cough; stridor absent or slight on deep breathing.	One cord moderately abducted and motionless, the other moving freely, and even beyond the middle line in phonation.	Total unilateral palsy.
Voice little changed; cough normal; inspiration difficult and long, with loud stridor.	Both cords near together, and during inspiration not separated, but even drawn nearer together.	Total abductor palsy
Symptoms inconclusive; little affection of voice or cough.	One cord near the middle line not moving during inspiration, the other normal.	Unilateral abductor palsy.
No voice; perfect cough; no stridor or dyspnœa.	Cords normal in position and moving normally in respiration, but not brought together on an attempt at phonation.	Adductor palsy.

Spasm of the laryngeal muscles affects the adductors only; is seen in children as laryngismus stridulus and rarely in the adult; it is characterized by very

marked dyspnœa, so persistent at times as to cause cyanosis. The attacks usually come on at night. The laryngeal crisis of locomotor ataxia is a laryngeal spasm. Spastic aphonia is a condition in which phonation is prevented by spasm.

Laryngeal anæsthesia is met in bulbar paralysis, in the neuritis of diphtheria and in hysteria. It is important that it should be recognized since particles of food may block the trachea or be drawn into the lungs. Dysphagia is a common symptom of this affection.

The cardiac branches. The nerve supply of the heart is derived from the vagus and sympathetic nerves. The vagus supplies motor, sensory and probably trophic fibres.

The motor fibres of the vagus inhibit, control and regulate the action of the heart. Irritation of these has an inhibitory influence upon the cardiac rate which results in retardation of the pulse (bradycardia). Entire vagus paralysis results in loss of this inhibitory influence, consequently the cardiac accelerator action is uncontrolled and the heart rate becomes rapid (tachycardia). It is an interesting point that total paralysis of one pneumogastric may be without symptoms. Disorders of the motor functions of the vagus may result from the pressure of new growths, accidental ligation or injury of the nerve, neuritis or irritation at its nuclei of origin. Individuals are on record who seemed to have voluntary control over the heart's action, and it is possible in some instances to slow the pulse rate by pressure over the nerve in the neck.

Sensory disorders of the vagus are rare and obscure, but the sensations accompanying palpitation, pain or irregularity are transmitted through this nerve.

The theory that the vagus exercises a trophic influence is based upon the fact that fatty degeneration of the heart has occurred after injury to this structure.

The gastric and œsophageal branches. The vagus sends motor and sensory fibres to the stomach. Through the former both central and reflex excitation cause vomiting. The peristalsis of the stomach is presided over by the vagus but that other influence is also at work here is evidenced by the fact that section of this nerve is not followed by the subsidence of all gastric motion. Œsophageal spasm and deglutition are controlled by these fibres.

The sensory impulses conveyed through the pneumogastric nerve are believed to be those of hunger and thirst since these have been lost in lesions affecting its root; however, in some instances of disease of the nerve the appetite has remained normal or has been abnormally increased. The gastric crises of locomotor ataxia are the result of central irritation of the nuclei of origin of this nerve.

The pulmonary branches. Of the function of these little is known. It

is supposed that they supply the bronchial musculature and asthma has been considered a neurosis of these fibres. The changes in the rate of respiration are believed to be due rather to the respiratory center than to vagus influence. Hiccough may result from lesion of this nerve.

The course and prognosis of disorders of the pneumogastric nerve vary with the cause of the condition in question. In those due to central lesion or intra-thoracic neoplasms or aneurysms it is not encouraging, while those resulting from local affections and hysteria may be favorably affected by proper treatment.

Treatment depends altogether upon the ætiology of the condition under consideration. Central disease of syphilitic nature should be amenable to the influence of potassium iodide in ascending doses or to the syrup of hydriodic acid, one drachm (4.0) three times a day. Laryngeal paralyses due to recurrent nerve pressure from tumor or aneurysm are hopeless unless the tumor is specific in nature or removable by operation. In patients of rheumatic tendency the possibility of this element in the causation of laryngeal muscular disorders must be considered. Here the salicylates, alkalies and iodides may prove beneficial. When the affection is a part of a general neuritis the treatment is that of this condition (see p. 788).

Paralyses of inflammatory origin should receive local treatment (see p. 788), in those due to hysteria the electric current is indicated and the daily hypodermatic administration of strychnine nitrate in doses of $\frac{1}{60}$ to $\frac{1}{20}$ of a grain (0.001–0.003) is useful. Laryngeal exercises and massage performed by grasping the upper and back part of the thyroid cartilage between thumb and forefinger and phonating at the same time, may also be employed.

The inhibitory fibres of the vagus may be stimulated in tachycardial states by digitalis and in bradycardia due to hyper-irritation of the cardio-depressory apparatus, atropine may be found useful. The general condition of the patient may require general hygienic and tonic treatment.

DISEASES OF THE ELEVENTH PAIR: THE SPINAL ACCESSORY NERVES.

Paralysis or spasm of this pair of nerves may occur as a result of involvement of their nuclei in bulbar paralysis; its external nuclei in the cervical region of the cord may be affected in degenerative processes of the motor nuclei of the cord; within the cranium the nerve is subject to pressure from tumors and meningeal exudates, and outside the skull it is subject to injury and to involvement in tumors, vertebral necrosis and cervical abscesses.

The internal or smaller division of this nerve joins the vagus and supplies through it the muscles of the larynx. Paralysis of this portion has been

discussed under laryngeal paralyses. The external or spinal division innervates the sterno-mastoid and trapezius muscles.

Paralysis of the external portion of the nerve is evidenced, when unilateral, by interference with the rotation of the head toward the sound side; torticollis is absent but the head may be held in an oblique position. The trapezius, receiving, as it does, innervation from other sources, is only partially paralyzed; that part, however, which extends from the acromion process to the occiput is useless and the middle portion of the muscle is weakened, consequently the shoulder is slightly lower than normal and is rotated inward by the unopposed action of the rhomboids and the levator anguli scapulæ. In respiration and shrugging of the shoulders the disorder is plainly evidenced and there is imperfect ability to lift the arm since the trapezius fails to fix the scapula and to give the deltoid a point from which to work; atrophy and the reaction of degeneration are usual.

Bilateral paralysis is evidenced by loss of power to hold the head upright. If the sterno-mastoids are involved, the head is prone to fall backward; if the trapezii are affected it droops forward, a characteristic of progressive muscular atrophy and also a symptom of meningitis in the neighborhood of the foramen magnum and of cervical meningitis following caries of the spine. Injury of the spinal accessory nerves during childbirth may cause a falling forward of the child's head lasting usually not beyond the first year.

The treatment of these conditions should strike at the ætiological factor. If the disease is central the condition is hopeless. Pressure paralyses may be relieved by surgical or orthopædic measures; this done the wasted muscles should be treated by massage and the electric current. Faradism is more effectual than galvanism.

Accessory spasm, torticollis or *wry neck* is caused principally, although not entirely, by spasm of the muscles supplied by the eleventh nerve; two types are described.

a. Congenital or Fixed Torticollis. This condition affects the right side more usually and may result from injury to the sterno-mastoid during labor or occur as a congenital developmental defect. Injury of the muscle followed by cicatricial contraction may produce a like condition later in life. The muscle is shortened, tense, firm and usually atrophic, and associated with the congenital type is an asymmetry of the face which may be, together with the wry neck, the result of some central cause analogous to that producing talipes.

The treatment of this condition is wholly surgical or orthopædic, and often is quite satisfactory although the facial asymmetry sometimes persists or becomes more marked.

The operations applicable to the condition are those of section of the muscle or tenotomy.

b. Spasmodic Torticollis. This affection occurs in both a tonic and a clonic form. Both varieties may occur in the same case or, what is more usual the condition assumes at its outset one type and does not change. It is observed most often in adults and in America seems more frequent in males, although the opposite appears to be the case in England. Exposure and trauma are factors in its ætiology; it may be due to hysteria and is prone to occur in individuals of neurotic heredity.

The *tonic* type is evidenced by approximation of the occiput to the shoulder on the affected side, elevation of the chin and turning of the face toward the sound side. This position is due to contraction of the sterno-mastoid. Involvement of the trapezius draws the occiput still further downward and toward the side affected. The affected muscles are tense and prominent and their continued rigidity may produce, in long-standing cases, a spinal curvature (scoliosis) with its convexity toward the unaffected side. Involvement of the scaleni and the platysma and rarely of some of the deep muscles of the neck may co-exist. Bilateral spasm (retro-collic spasm) draws the head backward, even so far that, in extreme instances, the face is directed upward.

In the *clonic* form attacks of twitching of the head, sometimes of severe type, may appear without previous symptoms or they may be preceded by pain or stiffness. In unilateral spasm of the sterno-mastoid each contraction turns the head toward the unaffected side and raises the chin; when the trapezius is involved the head is drawn back and toward the shoulder of the same side. In bilateral spasm of both sides there is paroxysmal retro-collic spasm at times combined with nodding movements; the movements may occur every moment or two and the head cannot be kept still. Enlargement of the muscles induced by their continued exercise results. Other muscles of the neck may be affected and at times even those of the arms. During sleep the contractions cease; after fatigue, excitement or emotion they are accentuated. Pain may accompany the spasms.

The condition is an obstinate one. Treatment may have little effect and, at best, recurrences are frequent.

Treatment consists in the removal of the cause of the condition if this can be ascertained. Acute attacks necessitate confinement to bed and the application of heat, moist or dry. Large doses of the bromides may lessen the spasms and other sedatives may be employed. The fluidextract of cannabis indica in increasing doses has been given but little benefit is to be expected from its use. Morphine hypodermatically will relax the spasm but the danger of producing the habit should never be forgotten. Recoveries have been reported due to this drug given for several months in doses increased to 1 grain (0.065) daily but it is likely that when the patient is cured of his spasm that the physician will have induced the morphine habit and will then have this condition to deal with.

The hypodermatic injection of atropine into the muscles involved has been advocated.

Electricity may prove beneficial. Both galvanism and faradism may be employed; if the former, the current should be weak, the positive pole being applied to the occipital insertions of the sterno-mastoid and trapezius, and the negative to each affected muscle in turn for ten or fifteen minutes. Faradism should be applied by brushing the involved muscles, the current being gradually increased in strength.

Surgical treatment consisting of stretching, section, or excision of the nerve, may give temporary relief and the more radical procedure of dividing the spinal accessory nerve together with resection of the posterior branches of the upper two or three cervical nerves may diminish the spasm.

DISEASES OF THE TWELFTH PAIR: THE HYPOGLOSSAL NERVES.

Paralysis of this, the motor nerve of the tongue and of the depressors of the hyoid bone and of the hyoglossus and geniohyoid muscles, takes place in *cortical lesions* such as apoplexy, cerebral compression, thrombosis, embolism and softening, and in *nuclear* and *infra-nuclear* disease. In the latter lesions the disturbance of the hypoglossal nerve results rather from slow degeneration such as usually occurs in bulbar paralysis and locomotor ataxia, than from acute softening. Tumors, basilar meningitis, and lesions of the cranial bones may involve the nerve, and outside the skull it is subject to injury, involvement in a cicatrix and pressure by tumors. Neuritis of the twelfth nerve may occur as part of a polyneuritis.

Paralysis of the hypoglossal nerve is characterized by loss of motility of the tongue. In unilateral paralysis only half the organ is involved and it is protruded toward the affected side; in bilateral palsy the organ remains without motion in the floor of the mouth; speech is difficult, mastication and swallowing are interfered with. There is partial or complete atrophy of the tongue, as the case may be, and its mucous membrane is thrown into folds. In disease above the nuclei the atrophy is absent and the electrical reaction remains normal. If the causative lesion is below the nuclei there may be fibrillary twitching and the reaction of degeneration is present.

Spasm is rare unaccompanied by other manifestations and may be unilateral or bilateral. Usually it is associated with some other convulsive disturbance such as chorea, epilepsy or spasm of the muscles of the face; in some instances of stammering, spasm of the tongue precedes the utterance of the words; it may be observed in hysteria or result from irritation of the fifth nerve. It is more often bilateral and may occur paroxysmally; in severe instances the

tongue may be quickly thrust in and out many times a minute and this may persist during sleep.

Treatment should be directed at the causative lesion and should this prove incurable, the condition is likely to prove permanent. In paralysis, electricity may be employed, the electrode applied to the tongue being in the form of a tongue depressor. Electricity may be used in spasm also and here good results may attend the administration of the bromides and other sedatives. Potassium iodide is also recommended.

FUNCTIONAL DISEASES OF THE NERVOUS SYSTEM.

ACUTE CHOREA.

Synonyms. Sydenham's Chorea; Chorea Minor; St. Vitus' Dance.

Definition. A disease characterized by irregular involuntary contractions of the muscles, sometimes accompanied by mental disorder and frequently associated with endocarditis and rheumatism. It is most often seen in children.

Ætiology. Chorea occurs chiefly between the ages of five and fifteen and seems to affect females more often than males. It is more common in the lower walks of life and heredity may have some influence in its causation. It is rare in negroes and has never been observed among the American aborigenes. The nervous temperament is a predisposing cause; emotional excitement, fright and grief, as well as over-study, may excite the disease. Imitation is considered, at present, to have little influence as an ætiologic factor, and the same is true of reflex irritation, digestive and otherwise, as well as of eye-strain.

Chorea has been considered closely associated with acute articular rheumatism by English and French authorities for many years, German observers however, do not regard their connection as so intimate. The chorea may succeed the joint manifestations after considerable periods of time, while in other cases the arthritis may be closely followed or be accompanied by this disease. It is probable that the joint symptoms are often overlooked, since rheumatism in children may be manifested by any slight swelling of a single joint or by vague pains. While the so-called growing pains of children may be rheumatic in character it is well to keep in mind the fact that this is not always the case.

Endocarditis has been held to be a cause of the disease and is often associated with it. Chorea has followed the acute infectious diseases, such as pyæmia, gonorrhœal and syphilitic constitutional infection, puerperal septicæmia, diphtheria, scarlatina, measles, typhoid fever, etc., but it is probable that

the relationship between chorea and these affections is not close. Anæmia may act as a predisposing cause and often results from this disease and it may occur during pregnancy. Poisoning by iodoform, carbon dioxide and other substances have seemed to cause short attacks.

Pathology. There are no definitely recognized *post mortem* changes characteristic of chorea; the numerous lesions which have been found are due to complications or are coincident. The accepted theory of the disease is that it is a functional affection of the nerve centers presiding over the motor apparatus. Associated with chorea have been found endocarditis in a large majority of cases, pericarditis and other miscellaneous diseases.

The embolic theory of chorea based upon the finding of emboli in the cerebral vessels, will not account for all instances; for while such lesions have been made out in a number of instances, there are others in which these were wholly absent even when distinct endocarditis existed.

With regard to the consideration of chorea as an infectious disease nothing has as yet been definitely proven.

Symptoms. The onset of the disease is usually gradual, the first manifestations being those of excessive nervousness, with restlessness and mental irritability. The condition occurs in three types which differ mainly in degree.

a. The mild variety with only slight involvement of the muscles and only slight disorder of speech and general health.

b. The severe form with generalized choreic movements, inability to talk and to perform the ordinary duties of life.

c. The maniacal type.

After the restlessness and irritability, the motor symptoms are first to appear. These usually involve the upper extremities, later the face and still later the legs, although rarely the legs may be first affected or the movements may be general from the outset. The patient drops objects and is unable to dress or feed himself, the gait is disturbed and there may be spasms of the facial muscles. The spasmodic movements may finally extend to all parts of the body or are limited to one side (hemichorea), they are irregular, jerking, arrhythmical and vary from an almost unnoticeable contraction of the muscles to constant twitchings. They are wholly involuntary and efforts at control often increase them. They are augmented by fatigue or excitement but seldom persist during sleep.

Speech is involved in many patients and the disturbance of this function varies from mere hesitance to entire incoherence. Muscular weakness appears as the disease progresses and, in consequence, the patient's gait may be limping and his grip weakened.

Sensory manifestations are not marked although there may be pain and tenderness in the limbs. Pain may be elicited by pressure over the points of

emergence of the spinal nerves and sensations of numbness or tingling may occur. The reflexes usually remain normal but may be exaggerated or lost. Trophic manifestations are very seldom observed.

Mental symptoms are, as a rule, not marked but melancholic states and hallucinations may occur. *Chorea insaniens* may develop from the milder types and is most common in women.

Heart symptoms are very common and this organ should be most closely watched in all cases. Irregularity of the cardiac pulsations and particularly increased rapidity of its action are very common and in cases associated with anæmia, the hæmic murmur, a soft ventriculo-systolic bruit at the base or apex, is very frequently audible.

True endocarditis in chorea is seldom evidenced by symptoms, but frequent physical examination of the heart in a great majority of patients will reveal the presence of organic cardiac lesion. Any of the valves may be attacked but those of the left heart are by far the most likely to be affected. The endocarditis is of the simple verrucous type as a rule and is likely in many instances to result, in after years, in permanent valvular disorder. Pericarditis not infrequently complicates chorea, especially rheumatic instances.

Rise of temperature in chorea is usually due to complicating conditions, except in the maniacal type, when a febrile movement even as high as 104° F. (40° C.) may occur. At times the surface temperature of the affected side in unilateral chorea may be slightly elevated.

Skin affections are sometimes seen and are often due to the continued administration of arsenic. This drug causes spots of pigmentation, herpetic, papillary and erythematous eruptions. Other cutaneous manifestations observed in chorea are usually rheumatic in character such as erythema nodosum, purpuric urticaria or the peliosis rheumatica of Schönlein. Sometimes the excessive motion may abrade the skin in exposed localities.

The prognosis as regards recovery in chorea, except in the maniacal type, which is usually fatal, is good, two to three months being the usual duration of an ordinary case; recurrences are frequent, however, and while the complications involving the heart may not result in permanent affection of this organ, they are only too likely to become chronic and distressing.

Instances of chorea in which the duration of the disease is unusually protracted should be examined for causes of peripheral irritation. The chorea of pregnancy is of severe type.

Treatment. The prophylaxis of chorea is important and consists in carefully watching all unusually bright children, especially if of neurotic heredity, and preventing any over-study or other mental over-activity. Competitions for school prizes should be heartily discouraged.

The general hygienic treatment of this disease consists of removal from school and seclusion from all excitement. The patient should not be reproved

or ridiculed because of his movements and his small faults and wrong doings should be condoned. In the milder instances the patient need not be confined to bed but in those of severer type it is best to advise this measure. When possible, a trained nurse should be procured and the patient should be separated as far as possible from exciting and disturbing influences. Oftentimes it is better to keep the child from his parents and relatives since sympathy and indulgence accentuate the condition. Patients who have done poorly at home often begin to improve at once in a hospital where they are properly restrained and encouraged toward self-control. The importance of rest in bed is particularly to be emphasized in cases in which there is any suggestion of a heart lesion. Here massage and warm bathing are of great benefit. In mild instances which are allowed to be up, gymnastics may be employed but only in moderation and under intelligent supervision. In the severe instances they may do positive harm. Cold sponging is also of benefit in the mild type of the disease.

The drug which seems to affect chorea most favorably is arsenic; it probably has no specific action, its beneficial effect being due to its improving influence upon the general condition. Liquor potassii arsenitis (Fowler's solution) is the preparation to be preferred. Often it seems to fail because of insufficient dosage. The beginning dose for a child of eight to ten years is from four to five drops (0.26–0.33) three times a day and increased by one drop (0.065) daily until the physiological effect is manifest as evidenced by disturbance of the alimentary tract and œdema under the eyes. When this occurs the drug should be stopped, to be resumed after several days in the same dosage as when left off and continually increased until from fifteen to twenty-five drops (1.0–1.66) are taken at each dose. The solution should be given after meals and well diluted. When the movements cease the drug should be stopped. Arsenical poisoning seldom occurs but in very rare instances a neuritis has been induced.

In rheumatic patients, where other drugs have no influence, sodium salicylate in full dosage should be administered and may effect permanent cure.

Opium or morphine should not be employed, except in instances marked by insomnia and restlessness; the bromides are useful and in very severe and obstinate instances hydrated chloral may be given.

In mild instances good results have followed the administration of an infusion of cimicifuga racemosa (black snakeroot) in doses of 1 or 2 ounces (30.0–60.0) two or three times a day. The zinc salts, silver nitrate and copper sulphate are little used at present. The use of hyocsyamine hydrobromide, given hypodermatically in doses of $\frac{1}{100}$ of a grain (0.0006) three times a day, has been recommended and hyoscyamus may be given in combination with zinc valerate as in the following formula: ℞ zinci valeratis, extracti hyoscyami, bismuthi subnitratis āā gr. xv (1.0). Massa fiat et divide in pilulas

no. xxv. Sig., three to six pills daily. Antipyrine may succeed in certain cases where other means fail and may be given in doses of from 7 to 10 grains (0.5–0.66) three times a day to a child of eight years. Strychnine may be useful in certain patients and from $\frac{1}{100}$ to $\frac{1}{60}$ of a grain (0.0006–0.001) may be given three times a day. Aspirin is advocated in severe and persistent instances and should be particularly effective in those in which the rheumatic element is present. In children over seven the beginning dose is 10 grains (0.66) twice a day increased to 10 or 15 grains (0.66–1.0) four times a day. This drug may cause gastric irritation and tinnitus. Cerebrin is another drug which has been recently recommended.

Very severe and otherwise uncontrollable movements may necessitate the intermittent administration of chloroform.

For the anæmia which frequently is co-existent with chorea, iron should be given either in the form of the Blaud pill (pilula ferri carbonatis) one or two, three times a day, in mixture such as the following: ℞ ferri citratis, ʒii (8.0); syrupi, ʒiv (16.0); aquæ aurantii florum, ℥iss (48.0). Misce et signa, one teaspoonful (4.0) three times a day, or in the form of iron vitellin. The iron may often be advantageously combined with arsenic. Electricity may prove beneficial on account of its tonic effect.

The eyes and nose should always be thoroughly examined for sources of reflex irritation and when present these should be corrected. The possibility of the presence of intestinal parasites should also be considered.

The general nutrition should receive particular attention; the food should be easily digestible and nourishing; tea and coffee should be prohibited. The bowels should be kept open.

Cases which go on for considerable periods resisting all forms of treatment often are greatly benefited by change of air and surroundings.

The chorea of pregnancy should be treated by insisting upon rest and quiet, nutritious food and good nursing. As sedatives, hydrated chloral and chloralamide are to be preferred to opium or the bromides and the arsenic prescribed should be combined with alcohol, the latter drug being, in the opinion of certain observers, the more important of the two. It is seldom necessary to induce labor on account of the severity of the chorea and spontaneous abortion as a result of the affection is not very frequent.

Chorea due to sepsis, puerperal or otherwise, has been successfully treated by intravenous injections of collargol. Two to five drachms (8.0–20.0) of a 2 percent. solution may be injected into one of the superficial veins of the arm.

CHOREIFORM AFFECTIONS.

These occur in several forms and may be described as convulsive contractures. They are often spoken of as "tics" or "habit spasms."

CONVULSIVE TIC.

Synonyms. Habit Spasm; Habit Chorea.

This condition is most often seen in children, girls particularly, from seven to fourteen years of age. The spasm usually affects the facial muscles, either a single one or a group. The milder types consist of rapid opening and shutting of the eyes, drawing the mouth to one side, jerking or shaking the head while the eye is winked at the same time, shrugging one shoulder or sniffing.

The leg muscles are more rarely involved although the "string-halt", tic in which one leg is suddenly lifted at intervals, may occur. These affections are rarely permanent although at times they may persist through life. They usually disappear gradually in a few months.

Treatment consists in the removal of any cause of irritation. The eyes and nose should be examined, decayed teeth drawn, etc. General tonics and nerve sedatives are indicated. Otherwise the treatment is identical with that of spasm of the facial nerve (p. 803).

IMPULSIVE TIC.

Synonym. Gilles de la Tourette's Disease.

This affection occurs chiefly in children of neurotic heredity. More rarely it develops after the age of puberty. It is probably best considered as a psychosis akin to hysteria and is characterized by involuntary movements involving the muscles of the face or arms. In marked instances the spasms may be general. The particular characteristic of this affection is the tendency to the explosive utterance of words or sounds simultaneously with the movements. A sound heard may be repeated numberless times (*echolalia*) or the patient may repeat blasphemous or obscene words (*coprolalia*) to the great distress of his family and friends.

Actions may be imitated (*echokinesis*). There may be mental disorder characterized by fixed ideas; for instance the patient may repeat time after time names which he hears (*onomatomania*) or before performing a certain act may count a certain number of times (*arithmomania*). Another manifestation is the fear of contact with certain objects (*délire du toucher*), still another is to require a reason for the most ordinary acts (*folie pourquoi*).

Any of these symptoms may occur with the convulsive movements and the latter may vary from slight spasm of a facial muscle to contractions affecting all the muscles of the body. The condition is usually easy of diagnosis, the coprolalia being considered its most characteristic feature. The prognosis is uncertain but patients have been known to recover.

The treatment is chiefly moral and occasionally hypnotic suggestion succeeds.

SALTATORY SPASM.

Latah; Myriachit; Jumpers; Mali-mali.

The saltatory spasm is a condition in which the patient is affected by vigorous contractions of the muscles of the legs which occur only when he is standing. It is seen in individuals of neurotic habit, both men and women; the affection may be transitory or persistent, and seems closely akin to the latah of the Malays and mali-mali of the Filipinos. Amongst the Malay race it seems to chiefly attack women who, when affected, imitate the movements of those about them even though they make strong efforts to desist; echolalia may co-exist with this imitation of motion. Heredity seems to be a factor in its causation, and those affected by it are subject to attacks of "running amuck" (see p. 846). The myriachit of Russia and Siberia and the jumpers of the Maine woods and Canada are analogous conditions. Those subject to the latter disorder, when under any emotional influence, jump violently and cry out; they may obey a sharp command or imitate actions or sounds.

CHRONIC CHOREA.

Synonyms. Huntington's Chorea; Hereditary Chorea.

Definition. A chronic disease characterized by irregular movements, speech disturbance and gradually increasing dementia.

Ætiology. The most important role in the causation of this disease is played by heredity, the affection having been observed in certain families for generations; the family originally reported by Huntington in 1872 still exhibited the tendency to it as late as 1898. The family affected is usually of neurotic tendency and in marked instances over 50 percent. of the members are affected. The disease seldom begins earlier than the age of thirty and sex seems to have little influence in its causation. Idiopathic instances have been observed.

Pathology. This affection exhibits no typical *post mortem* lesions, although the changes which are usually found in chronic dementia—atrophy of the cortex, meningo-encephalitis and changes in the cerebral vessels—are often present. It is probable that the disease is in no way akin to chorea minor.

Symptoms. In the hereditary form of the affection the onset is usually sudden with irregular movements of the hands; the performance of fine voluntary movements is difficult. Later the face becomes involved and the gait is disturbed. The movements differ from those of chorea minor in that they are slower, more irregular and lack coördination. The gait is swaying, the patient may seem about to fall and then by an effort recover just as an intoxicated person does. The movements are not present while the patient is at rest, may be to some extent controlled by the will and are increased by excite-

ment. The speech is slow, interrupted and indistinct; writing is difficult at first and later impossible.

Sensory disorders are absent, the special senses and muscular sense usually are not affected although the latter may be disturbed late in the disease.

The disorder of mentality begins as a depression and an irritability, passing to feeble-mindedness and finally to complete dementia. Suicidal tendency occurs and the act may be committed.

The disease is progressive and finally fatal.

Treatment consists merely in the control of the symptoms as they arise. The patient's general health should be cared for by prescribing tonics, nourishing food and a life in the open air. Nothing can be done to arrest the progress of the disease.

EPILEPSY.

Synonyms. Falling Sickness; Morbus Divinus; Morbus Astralis; Morbus Sacer.

Definition. Epilepsy is a chronic functional nervous disease characterized by paroxysmal seizures typified by loss of consciousness and usually by convulsions.

Jacksonian epilepsy is characterized by recurrent convulsions affecting particular groups of muscles and is frequently not accompanied by loss of consciousness.

True or idiopathic epilepsy is of three forms:

1. *The grand mal*, the most severe, in which the convulsions are marked and the loss of consciousness is distinct.

2. *The petit mal*, in which the convulsions and unconsciousness are of trivial character.

3. *Psychical epilepsy* which is characterized by mental disorder or violent acts.

Ætiology. As a predisposing cause heredity must be considered to exert the most definite influence, about 30 percent. of patients showing a history of mental disease or epilepsy in the family. Other predisposing causes are alcoholism, consanguineous marriage, syphilis, plumbism, mental disturbances during pregnancy and traumatisms during parturition. Sex seems to have no distinct influence. The disease usually develops between the ages of ten and twenty, although it may appear before the age of five. After twenty years of age the incidence of epilepsy is rare.

Exciting causes are rickets in infancy, alcoholism, syphilis, head injuries, the acute infectious diseases and masturbation. Reflex causes are disorders of the genital system and of the digestive tract, intestinal parasites and constipation, and ocular and aural irritations.

Pathology. The pathology of true idiopathic epilepsy is unknown. Lesions have been described as occurring in cases in which a syphilitic element is present or in which vascular anomalies exist, but in epilepsy in which such conditions are wanting, no constant alterations in the nervous system are found. In Jacksonian epilepsy distinct abnormalities are present such as tumors, localized meningeal thickenings and injuries to the cranial bones resulting from trauma.

Physiology. The epileptic paroxysm is to be considered an explosion of nerve energy, the seat of this discharge being the large motor cells of the cortex; the same mechanism is responsible for paroxysms of psychical epilepsy.

Symptoms. In discussing these, the four chief types of epilepsy will be taken separately.

1. *Grand mal.* There are frequently prodromal symptoms for a day or for only an hour or two before the attack, such as vertigo, or irritability. In many cases the paroxysm is ushered in by a peculiar sensation known as the *aura.* This may be a wave-like sensation rising from the feet, involving the body and when it reaches the head the convulsion and unconsciousness occur. In other individuals it may be manifested by a sensation of epigastric discomfort; auditory auræ, such as the hearing of voices or musical sounds, visual auræ such as a flash of light or color or the appearance of objects or faces and olfactory or gustatory auræ causing sensations of smell or taste are not uncommon. Accompanying the aura and the onset of the paroxysm many patients cry out. As this cry is uttered the patient falls and the first or tonic stage of the attack begins. In the *tonic spasm*, which lasts fifteen or twenty seconds, the head is drawn back or to the side, the limbs and body are rigid, the elbows and wrists are flexed, the hands clenched and the legs and feet extended, respiration ceases and the face becomes swollen and cyanotic, the neck may be twisted and the vertebral column curved. The *clonic spasm* now supervenes and is characterized by convulsive movements of the face and limbs, the latter being violently flexed and extended; the facial muscles are involved, the eyeballs roll and the lids open and shut; saliva collects in the mouth and is churned into froth by the contractions of the muscles of the jaw, the froth becoming bloody if the tongue is bitten. The urine and fæces may be passed involuntarily; the cyanosis becomes less; the temperature may rise ½ to 1° F. and the pulse, weak at first, becomes rapid and tense; later as the convulsions abate it becomes feeble once more. This stage lasts a minute or two, gradually subsides and the patient lapses into *the stage of coma.* In this condition the muscles are relaxed, the respiration is stertorous, the face suffused but not cyanotic. The coma passes into a slumber which may last several hours after which the patient awakes suffering perhaps from headache or confusion of mind, or on the other hand in normal condition save for stiffness and bruises.

The *status epilepticus* is a condition in which the unfortunate patient passes from convulsion to convulsion for hours or days, never regaining consciousness; later the convulsions are replaced by coma, or more rarely mania, and the patient dies of exhaustion.

After an epileptic seizure the reflexes may be lost; at times they are exaggerated; there may be slight temporary glycosuria or albuminuria; the red cells of the blood and the hæmoglobin are diminished.

2. *Petit mal.* In this form there is rarely an aura or a cry, the attack lasts but a few seconds, the patient stops suddenly whatever he may be doing, the features become set, the eyes open widely and are set, the pupils dilate, there may be slight muscular twitchings and consciousness is lost for the moment and he may fall. The attack is over after a few seconds and the patient resumes his former occupation conscious merely that he has suffered from a "spell." At times he may turn about, take a few steps or perform forced movements—*procursive epilepsy.* Seizures of *petit mal* may alternate with those of *grand mal* and as the disease continues the attacks increase in intensity and they may become entirely of the grand type.

3. *Jacksonian epilepsy.* This type of the disease is not characterized by loss of consciousness. The convulsion affects a single group of muscles or a limb. It is, as a rule, the result of a focal lesion of the motor area of the cerebral cortex such as a tumor, disease or injury. The attack begins with numbness, tingling sensations or muscular contraction (Seguin's sign) in the part to be attacked; the convulsions begin always in the same part, a finger, a toe or the face. The movements are tonic and clonic extending in regular order, for instance from a finger, to the hand and thence throughout the arm. After the attack the affected part may be numb or partly paralyzed and loss of tactile or temperature sense may be present. The situation in which the seizure begins is important in determining the localization of the brain lesion and in fixing the site for operative intervention.

4. *Psychical epilepsy* follows *petit mal*, more rarely *grand mal* or, occurring independently, is considered a "psychical epileptic equivalent." During the paroxysm the patient may exhibit mental violence, or perform extravagant acts, sometimes criminal in character. Accustomed acts may be performed during a somnambulistic condition which at times occurs in place of the ordinary seizure; these are often complicated and include driving, walking, etc. Abortive attacks of psychical epilepsy lasting but a few seconds and consisting of a short tonic and a very mild clonic stage are sometimes seen.

Grand mal is the type of the disease most frequently observed, next in order comes the mixed type while *petit mal* is still less common. Jacksonian and psychical epilepsy are rarest of all.

During the developmental stage of the disease, major attacks may occur only two or three times a year. Gradually, however, they increase in fre-

quency until they may take place even several times a month. In very severe instances there may be daily attacks. Frequent seizures of *petit mal* are the rule; their daily incidence is not at all uncommon.

The most usual time of day for epileptic attacks is between 8 A.M. and 8 P.M. and a not infrequent time is early in the morning when the vital forces are at their lowest ebb. Nocturnal seizures are not rare. Between the attacks the patient feels well, indeed a nervous explosion may be followed by a distinct improvement in his condition.

The prognosis. This is best as regards recovery in patients with infrequent attacks. When the seizures are altogether during the day or at night the prognosis is better than in the mixed type. When the disease begins after twenty years of age the chances of recovery are better than in instances commencing earlier in life. While epileptic patients seldom die of the disease, their lives seem to be shortened by it and recovery is rather rare; about 10 percent. of instances result in insanity or dementia.

Of the different types of epilepsy the prognosis is worst in the psychical variety, better in *petit mal* and most favorable in *grand mal.*

Treatment. *Prophylaxis:* Neurotic children who have convulsions in infancy should command our best efforts to learn the cause of this manifestation, to remove it and to advise such an education and training as will result in both physical and mental health. Such children, when under the influence of a neurotic father or mother, often do better when brought up away from home.

Before beginning treatment a thorough investigation of the patient should be made in order to ascertain whether the condition is or not due to peripheral irritation. The blood, the urine and the fæces should be examined, the eyes should be investigated for evidences of eye-strain, the ears, nose, and mouth for signs of reflex irritation, the genitals for evidence of phimosis or masturbation; the digestive tract should be rendered as normal in its action as possible; gastric atony, intestinal fermentation and constipation deserve especial attention.

Another most important consideration is to institute treatment as early after the incidence of the disease as possible and to carry it out vigorously. Particularly should children who have had convulsions in early life receive careful attention and should the seizures be recognized as epilepsy, treatment should be continued for at least three years after the last attack has been observed.

Constitutional treatment with the view of absorbing or preventing sclerotic patches in the nervous system—such deposits having been observed in many cases—may be instituted. Here the alteratives, arsenic, mercury, sodium and gold chloride and potassium iodide, are indicated; if a syphilitic element is present appropriate treatment is necessary. Cases in which there are co-exist-

ent lithæmic or purinæmic conditions sometimes may be relieved by the use of saligenin tannate, gr. xv (1.0) three times daily with the alkalies and proper diet as adjuvants. Circulatory and vaso-motor disorders, which are not rare, may be combated by strychnine and other heart tonics and, in conditions of hypertension, by glyceryl nitrate.

In the specific treatment of epilepsy the bromides are the most useful remedies but are not without disadvantages. The most effectual of these are potassium bromide, sodium, strontium, rubidium and ammonium bromides and hydrobromic acid. While the action of all these agents is similar the potassium salt seems to be most effectual; at times it may be of benefit to the stomach or otherwise of advantage to change from one to another or to administer a mixture of several of the salts. Sodium bromide is less unpleasant to the taste than potassium bromide and less disturbing to the digestion; ammonium bromide is slightly stimulating to the heart. Hydrobromic acid may be given when the alkaline salts are disturbing to the alimentary tract; the bromide eruption is less likely to follow its use than that of the bromides.

The dosage employed should be sufficient to control the paroxysms, beginning at about 15 grains (1.0) four times daily and gradually increased until effectual. As much as 2 drachms (8.0) four times a day has been given; this amount produces bromism but, when necessary to suppress the attacks, may be employed, always with care, however, as harm sometimes results. The seizures having ceased, the dosage should be lessened, but the treatment should be continued for a couple of years at least. Nocturnal epilepsy may sometimes be controlled by a single large dose given at bedtime but as a general rule the drug is best given on an empty stomach either a little while before meals or two or three hours after.

The disadvantage of the bromide treatment is the likelihood of causing bromism which is manifested by drowsiness and hebetude, digestive disorders, cardiac distress and the typical bromide acne. It is difficult to mitigate these unpleasant symptoms unless the drug is stopped; the most approved measures to prevent their occurrence are the employment of salt water baths, massage and regular exercise with the administration of the bitter tonics, iron, cod-liver oil and the mineral acids. The acne may be prevented by the administration of arsenic, the unpleasant bromide eructations by combining the bromide with an alkali, though this may disturb the bladder; this disturbance may be relieved by giving the bromide in hydrobromic acid. The best method of taking the bromides is in carbonic or Vichy water in proportion of about ½ drachm (2.0) to a glassful.

In some instances, especially those in which the drug causes digestive disturbance, the bromides are ineffectual; in these obstinate cases they may be combined with solanum carolinense (the fluidextract, ½ to 2 drachms—2.0 to 8.0—three

or four times daily) and for patients whose intolerance to the bromides necessitates their omission, this drug alone may be prescribed.

It is said that if the sodium chloride of the diet is restricted or omitted entirely the bromides will prove more effectual and smaller doses may be employed.

Hydrated chloral and chloralamide are useful adjuncts to the bromides but should be, especially the former, given with care. Five to ten grains (0.33–0.66) of chloral may be combined with a diminished amount of bromide and given with good effect. Another combination which is deserving of trial is one of antipyrine, 6 grains (0.40) and ammonium bromide, 10 grains (0.66) given three times a day. Acetanilide may prove useful as also may monobromated camphor in doses of 5 grains (0.33).

Other drugs which have enjoyed vogue in the treatment of epilepsy and may be substituted for the bromides are the tincture of capparis coriacea, 1 drachm (4.0) four times a day, belladonna, zinc iodide and oxide, sodium borate, sulphonmethane and valerian.

In *petit mal* glyceryl nitrate given to the physiological limit is of service. Its dosage varies with the tolerance of the patient from $\frac{1}{100}$ to $\frac{1}{25}$ of a grain (0.0006–0.0024). The bromides also are useful and antipyrine, belladonna, cannabis indica, ergot and general tonic treatment may be employed.

The treatment of the seizure. The patient whom an aura warns of a coming attack is fortunate, for in amyl nitrite we have a fairly efficient means of preventing its onset. This drug may be carried in the pocket in the form of "pearls" or in a small bottle; the former may be broken at the appropriate time and the contents inhaled. Other methods of aborting a paroxysm are the inhalation of ammonia or chloroform, pressure over the carotid arteries, the internal administration of alcohol or aromatic ammonia spirit. Brower reports a patient whose aura began in the hand; about the wrist he wore a noose of thread which, when the warning appeared, he would tighten, thus stopping the progress of the paroxysm.

During the attack the patient should be prevented from doing himself injury and some such object as a spool, a bit of wood or a roller bandage should be inserted between the teeth to prevent biting of the tongue.

The *status epilepticus* should be combated by hydrated chloral given *per rectum* and the stomach and bowels should be emptied by lavage or by emetics and purges. Bleeding may be employed.

The treatment of epileptics at special institutions or colonies is strongly to be advocated. Here the mode of life may be properly regulated, the mind of the patient may be kept congenially occupied and physical work within proper limits prescribed.

Hydrotherapy. Systematic hydrotherapeutic measures are a useful adjunct to treatment; under their employment there is less likelihood of inducing brom-

ism and causing acne. By increasing the eliminative process of the organism as well as by the stimulating and tonic effect, the tolerance for the bromide is increased and its toxic power diminished. For a patient accustomed to a cold morning tub this measure may be prescribed, otherwise he may be given a dry or alcohol rub before rising; later the cold packs followed by a vigorous rubbing are admissible; when the patient's condition permits, a hip bath beginning at 90° F. (32.2° C.) and lasting five minutes may be given, the temperature being reduced one degree per day, until 80° F. (26.1° C.) is reached. Another useful procedure is the douche. Both this and the hip bath should be followed by vigorous rubbing by an attendant. Other balneo-therapeutic measures will undoubtedly suggest themselves as indications arise.

Jacksonian epilepsy may often be traced to head injuries and in cases of this type there is possibility of cure by removal of pressure upon the brain by surgical means. In other forms of epilepsy surgery can be of no benefit.

Diet. The dietetics of this disease is most important and the fact that this element in the management of epilepsy can be properly regulated in institutions is a strong point in favor of the employment of this form of treatment. The restriction of salt is a distinct advance in the treatment of this condition. The patient soon learns to do without sodium chloride and equally readily accustoms himself to the use of sodium bromide in its stead, and even may prefer it. The diet itself should consist of plain, nourishing and easily digested foods. Starchy indigestion should be avoided by guarding against a too exclusively vegetable regimen. For breakfast the patient may have fruit, a cereal, eggs, toast, rolls or biscuit and milk, buttermilk, or cocoa; at dinner a purée or clear soup is allowable, with fish, meat or fowl, vegetables and a simple salad, and fruit, plain puddings or ice cream as dessert. Supper may consist of bread or rolls, cold meat, oysters, sweetbreads or calf's brain and stewed fruit, with milk or cocoa.

Alcohol, tobacco, tea and coffee, sweets, fried foods and rich made dishes should be avoided.

MYOTONIA CONGENITA.

Synonym. Thomsen's Disease.

Definition. A disease characterized by hypertrophy of the muscles and by tonic cramp on attempting voluntary movement.

Ætiology. Myotonia congenita is an hereditary affection appearing, in all typical cases, in early childhood and in certain families. It had appeared in the family of its first describer, Thomsen, for five generations. Males are much more frequently affected than females and the disease is more frequent in Scandinavia and Germany than in England or America. The instances of acquired myotonia seem to differ somewhat from Thomsen's disease.

Pathology. The muscles, especially those of the limbs, are larger than normal and may be the seat of a true hypertrophy; they are, however, much less powerful than their appearance would imply. Microscopically the muscle fibres are sometimes enlarged and their nuclei increased, although the results of late research seem to show that this enlargement is not characteristic of the disease; the intra-muscular connective tissue may be increased and degenerative and regenerative changes have been observed. The theory has been advanced that the condition is the result of an autointoxication of the muscular tissue due to disordered metabolism.

Symptoms. The onset of the disease occurs in childhood and is first evidenced by a muscular stiffness which causes a delay in voluntary movement. There is no paralysis and when a movement is begun it is carried out. Rapid and accurate movement is impossible and a contraction may persist after its end has been accomplished. The arms and legs are chiefly affected; the gait is disturbed, in that there is a hesitancy at the start, after a few steps there is no difficulty in continuing. The condition is accentuated by excitement or cold. Rarely the muscles of the face, eye or larynx may be affected.

There is no abnormality of sensation or of the reflexes; the so-called myotonic reaction of Erb is present and is characteristic of this condition, the galvanic and faradic irritability of the motor nerves being quantitatively normal and short contractions result from briefly acting stimuli. With continuous excitation by either current the contractions slowly reach their maximum and slowly relax, while vermicular, wave-like contractions pass from cathode to anode.

There is no atrophy or considerable loss of power except in so far as the stiffness interferes with movement.

The disease resists treatment but the patients are often able to educate themselves so that the disability is but slightly noticeable.

Treatment consists merely in attention to the general health and the employment of massage and gymnastic exercises.

PARAMYOCLONUS MULTIPLEX.

Definition. A disease characterized by clonic contractions of various groups of muscles, usually of the extremities, occurring either in paroxysms or constantly.

Ætiology. Little is known of the causation of this condition. Heredity seems to be a factor in that many patients give a family history of various types of nervous disease. It is a disease of adult life and is more often observed in the male sex. It has been known to follow emotional disorders and fright.

Pathology. The morbid anatomy of paramyoclonus multiplex is still undiscovered.

Symptoms. The most marked symptom is the occurrence of clonic contractions involving chiefly the muscles of the limbs and trunk, rarely those of the face. They are bilateral, as a rule, sudden, and as many as 150 per minute may take place. Tonic spasms have also been observed. The contractions are increased by emotional states, are diminished by voluntary movement and are absent during sleep. At times the patient may emit a grunting sound which perhaps is due to involvement of the larynx and diaphragm. Between paroxysms there may be muscular tremors. In marked types of the disease the movements may be very violent and the patient may be with difficulty kept in bed. There are no mental, sensory or trophic symptoms and the electric reaction of the muscles is unchanged, though an electric stimulus may incite a paroxysm. The tendon reflexes are exaggerated.

The prognosis with regard to complete recovery is poor, the condition usually persisting for a number of years, although it may prove fatal within a few months.

Treatment consists in the employment of measures calculated to improve the general health, tonics, out-of-door life, nourishing food, etc. All possible excitement must be avoided. Arsenic, iron and phosphorus may be given and a course of hydrotherapy at a suitable institution may prove beneficial. The marked paroxysms of the severe types of the disease may necessitate the hypodermatic administration of morphine.

PARALYSIS AGITANS.

Synonyms. Shaking Palsy; Parkinson's Disease.

Definition. A chronic nervous affection characterized by muscular tremors, weakness and rigidity.

Ætiology. The causation of this disease is obscure. It occurs most often in individuals belonging to families in which other nervous diseases have appeared, is usually seen after the age of forty and is more common in males than in females. It may follow malaria and other infectious diseases and is predisposed to by alcoholism and sexual excess. Of exciting causes, exposure to cold, injuries, worry and mental over-exertion may be mentioned.

Pathology. There is no characteristic lesion but the disease is probably the result of some change in the cerebral cortex. The theory has been advanced that it is due to premature senile changes in the brain. Dana suggests that in paralysis agitans there is destruction and degeneration of the dendrites of the cells of the anterior cornua of the cord interfering with the even progress of motor impulses, leading finally to motor weakness and rigidity, owing to

severence of the connection between these cells and the brain, these manifestations having been preceded by a functional disturbance. According to Gordinier the primary change is in the blood-vessels, later it spreads to the adjacent neuroglia and results in patches of peri-vascular sclerosis; the abnormalities which have been observed in the anterior horn cells and in those of the motor cortex being due to diminished nutrition dependent upon the vascular changes.

Symptoms. Of these tremor, either constant or intermittent, and usually first affecting the hands, is earliest noted. The onset of the disease is slow as a rule although it may develop suddenly after exposure, trauma or emotion. The tremor of the hands is characterized by movements of forefinger and thumb resembling those made in rolling a pill; rotation and tremor of the forearm is also present. The arm is seldom affected and the movements of the lower limbs are most marked at the ankle joints. There may be nodding movements of the head. The movements at first are absent during sleep but finally remain present at all times. By an effort of will the patient may check the tremor but it returns, often exaggerated in degree. It is increased by excitement or emotion but may cease in states of excessive rigidity.

The accompanying muscular weakness is present in greater or less degree and is most apparent when the tremor is marked. Entire loss of muscular power is rare.

The rigidity is evidenced by impairment of activity, movement is stiff and retarded. This symptom is progressive and results in the attitude typical of the disease. Here the head and body are bowed, the elbows are flexed and held away from the body; the knees may interfere in walking and the patient may seem about to fall forward. He walks with eyes upon the ground before him and takes quick, short steps, acting as if he were about to fall forward and were endeavoring to prevent this calamity by continually changing his center of gravity. If pushed backward he is likely to fall being unable to maintain his balance. The facial appearance is changed, being expressionless and mask-like (Parrot's sign). Saliva may dribble from the partly open mouth or if this is kept closed, it may be found full of this secretion owing to delayed deglutition. The voice may be high-pitched and the speech slow, though if the lips and tongue are involved in the tremor, the patient may stammer. The reflexes remain unaltered or rarely are exaggerated. There may be altered temperature sense but otherwise there is no sensory abnormality. The skin may be thickened, particularly that of the forehead, it may flush easily or perspire excessively. The temperature, bowels and bladder are unaffected but there may be areas of heightened surface temperature.

The prognosis. The course of the disease is slow and gradual and, while periods of intermission may occur, its progress is continually downward; it lasts for years, the patient usually dying from intercurrent disease.

Treatment directed to the arrest of the condition is unavailing, consequently we can do little except to care for the patient's general health by the administration of proper food and tonics. Fresh air, exercises, electricity, massage and warm bathing are indicated.

With regard to drugs, hyoscine hydrobromide in doses of gr. $\frac{1}{120}$ to $\frac{1}{100}$ (0.0005–0.0006) or atropine, grains $\frac{1}{100}$ to $\frac{1}{60}$ (0.0006–0.001) may be given hypodermatically two or three times a day, depending upon the severity of the symptoms, and duboisine, opium, arsenic, and potassium iodide may be tried. Hot moist or dry compresses may be applied to the muscles if these are painful and if hyperexcitability of the nervous system is present, the bromides and hydrated chloral may be employed with benefit.

ECLAMPSIA.

This term is applied to reflex convulsions occurring in children and to the convulsions of the puerperal state in women.

INFANTILE ECLAMPSIA.

Synonyms. Infantile Convulsions; Epilepsia Acuta.

Definition. Convulsions due to peripheral reflex irritation.

Ætiology. Convulsions in children may result from very slight causes, usually reflex in character and due as a rule to digestive disorders, such as inflammations, intestinal parasites, foreign bodies, fæcal accumulations, vesical calculi, rickets, nephritis, and the infectious fevers. Children of neuropathic heredity are prone to exhibit this manifestation and it is the result of a hyperexcitable state of the nerve centers permitting sudden, excessive and transient discharges of nerve force.

Symptoms. The seizure may vary from mere twitching or clinching of the fingers to marked convulsive paroxysms closely resembling those of epilepsy (see p. 822). The attack may be single but often several convulsions may appear following one another at intervals of hours or days. Rarely does the seizure end in death. Frequently repeated convulsions may induce the "convulsive habit" and from this epilepsy may result.

The attack may appear without prodromal symptoms or it may be preceded by malaise and restlessness. The seizure is often accompanied by rise in temperature.

The prognosis of infantile convulsions depends upon the causative factor and the age of the patient. Life is seldom endangered except in very young infants and in rhachitic patients. Permanent brain impairment is rare but may occur. Convulsions at the onset of an infectious disease are rarely fatal and may not augur a severe type of the infection. Nephritic convulsions are

serious and in those of whooping cough and of asphyxia, the worst is to be anticipated.

Treatment. The child suffering from convulsions should be kept perfectly quiet. The mustard bath is better omitted and a mustard pack substituted. The latter is made by adding to one quart of tepid water a tablespoonful of mustard; a towel is wet in this and while dripping is wrapped about the patient's body; outside this a blanket is wrapped and he is allowed to lie in it for ten to fifteen minutes. At the end of this time the skin should be well reddened. The pack may be repeated at intervals as indicated. Cold compresses should be applied to the head. If the convulsion is of severe type, chloroform sufficient to control it should be administered and at the same time an enema of hydrated chloral dissolved in an ounce (30.0) of warm milk should be given. A child of six months may receive 4 grains (0.26), a child of one year 6 grains (0.4). This should be injected through a soft catheter passed high into the rectum, the buttocks being held together to prevent its discharge. If necessary the dose may be repeated in an hour. When the convulsions persist after the chloroform is stopped and in spite of the hydrated chloral, morphine should be administered hypodermatically. To a child of six months $\frac{1}{48}$ of a grain (0.0014) may be given; to one of one year $\frac{1}{24}$ of a grain (0.0025), to be repeated in one-half to one hour if necessary. If the heart is weak chloroform may be contra-indicated but morphine may be given. Oxygen inhalations may relieve the condition, especially in states of asphyxia when other treatment is of no avail.

The convulsions being under control it remains to prevent their recurrence. This is accomplished by continuing the administration of hydrated chloral in diminishing doses, with the addition of sodium bromide, or if the former is not well borne by stomach or rectum, antipyrine or acetphenetidine in small doses may be substituted. In addition to the above treatment the gastro-intestinal tract should be cleared of all possible irritant material by the administration of $\frac{1}{4}$ to $\frac{1}{2}$ a grain (0.016–0.032) of calomel every half hour up to six doses and by thorough washing out of the colon by means of a soft catheter and warm normal saline solution.

The further treatment consists in the regulation of the patient's food and mode of life, together with appropriate medication for the underlying condition.

PUERPERAL ECLAMPSIA.

The actual causation of this condition is not definitely known but it undoubtedly is the result of a toxæmia due to faulty metabolism and elimination. It is often associated with the albuminuria of pregnancy although it is by no means certain that renal lesion is its causation. The convulsions are usually

preceded by a feeling of fulness in the head, dizziness and arterial hypertension and may occur either before or after the uterus is emptied, usually however, before that event. The convulsions are both tonic and clonic and the condition is one which jeopardizes the life of the patient, consequently all possible measures should be taken toward its prevention by frequent urine examination during the later months of pregnancy and careful watching on the part of both patient and physician for premonitory symptoms.

Treatment. This consists, if the convulsions appear before the birth of the fœtus, in emptying the uterus as rapidly as possible. The treatment for the convulsion itself is to be carried out by the administration of chloroform and the employment of other means applicable to such conditions. If the arterial tension is excessive and cyanosis is present, venesection and the withdrawal of a considerable amount of blood should be practiced, the fluid withdrawn being replaced by the injection of an equal or larger amount of normal saline solution either directly into the vein or into the muscular tissues of the thighs or buttocks. The drug most likely to be of service is veratrum and it is best given hypodermatically in the form of the tincture, 30 to 40 minims (2.0–2.66) and repeated until the arterial tension has been reduced to normal limits.

The toxæmia should be treated by the administration of two to three copious (1 gallon–4 litres) high rectal irrigations of normal saline solution at a temperature of 105–110° F. (40.5–43.5° C.), daily; moderate diuresis and other means calculated to assist elimination are indicated. While any symptoms persist the diet should be entirely of milk.

TETANY.

Synonyms. Intermittent Tetanus; Tetanilla.

Definition. A nervous affection characterized by bilateral intermittent or continuous tonic spasms of the extremities, seldom involving one limb only and rarely becoming general.

Ætiology. The condition affects both adults and children. In the former it occurs in a so-called epidemic or infectious form in certain parts of Europe among young workingmen, especially shoemakers and tailors; as a result of digestive disorders and the infectious diseases; as a complication of various nervous diseases, notably exophthalmic goitre, syringomyelia and brain tumors; following morphine, ergot, chloroform, alcohol and lead poisoning; in uræmic states; in pregnant and nursing women; and as a result of removal of the thyroid gland. In the last case it is probably due to the excision of the parathyroid bodies which have been removed with the gland.

In children tetany has been observed in digestive disorders, in the acute infectious diseases and in rickets.

Pathology. This is not definitely known. It is supposed that the parathyroid glands exercise a neutralizing effect upon some poisonous substance produced by metabolism. This theory would account for tetany following the removal of these bodies, and the production of this poison in such an amount that the parathyroids are unable to neutralize it may account for the disease in other cases.

Symptoms. The spasm of tetany is usually limited to the limbs and extremities. The thumbs are flexed into the palms; the fingers are adducted and flexed at the metacarpo-phalangeal joints, remaining straight at the phalangeal articulations. There is flexion at the wrists and elbows and the arms are folded over the chest. In the lower limbs the hips, knees and ankles are extended and the toes adducted or there may be flexion of the knees and dorsal flexion of the feet. The skin over the extremities may be œdematous. The muscles of the face, neck and body are seldom affected; rarely there may be trismus with drawing out of the angles of the mouth. Tenderness and pain accompany the spasm as a rule. The contractions in children usually last only a few hours; in adults they may be prolonged for several days or even weeks. When the condition is very acute there may be acceleration of the pulse and elevation of temperature.

Other symptoms characteristic of the disease are *Chovostek's*—a contraction of the muscles caused by light tapping along the course of a nerve; *Trousseau's*—the induction of spasm by pressure over the affected part, especially along a nerve trunk or over a blood-vessel; *Erb's*—exaggerated electrical irritability, especially to galvanism, and *Hoffmann's*—the production of paræsthesia by pressure over a sensory nerve. Difficult urination or inability to perform this function may be observed. The reflexes are exaggerated.

The prognosis of the disease is good, recovery usually taking place in a few days or more rarely after a month or two. Recurrences are common especially in the winter and early spring.

Death may occur in instances due to severe gastric lesions or those due to removal of the parathyroid glands.

Treatment consists first in removal of the cause of the condition; any digestive disorder should receive appropriate treatment and the same is true of rickets. The spasm may be relieved by hot baths, an ice bag applied to the spine or if necessary chloroform may be given by inhalation; frictions, massage, passive movements and the electric current may be employed with benefit and a properly hygienic mode of life should be prescribed.

Of drugs those which have a sedative action in spasmodic conditions should be employed. The bromides, hydrated chloral and antipyrine are the most useful. In cases characterized by severe pain the hypodermatic administration of morphine may be necessary.

The extract of the thyroid gland is said to relieve certain patients, even those

in which parathyroid excision has not been performed. The beginning dosage of this substance is 5 grains (0.33) three times a day.

Thyroid transplantation has been suggested.

In instances due to gastric dilatation, cure may result from one of the surgical operations adapted to the treatment of this condition, or if this mode of treatment is contra-indicated or refused by the patient, frequent and thorough lavage, according to the methods laid down under the treatment of gastric dilatation, should prove beneficial.

HYSTERIA.

Definition. An abnormal condition of the nervous system characterized by morbid changes in the functions of the body resulting from lack of mental control over acts and emotions and by exaggeration of sensory impressions.

Ætiology. Heredity has a direct influence upon the causation of this disease and even if true hysteric conditions have not occurred in the ancestry there is often a family history of other nervous conditions, such as epilepsy, insanity, mental degeneration, etc. Alcoholism and drug habits as well as consanguineous marriage are factors in its production. While hysteria is more common among females it is by no means seldom observed in males. The age at which the disease is most frequently met is from that of puberty to the thirtieth year. The Anglo-Saxon races are much less prone to the disease than are the Latin races and it is particularly frequent among the Hebrews. The hysterical temperament is likely to develop in pampered individuals who have been accustomed to excessive sympathy and to make much of every slight ailment.

Hysteria is more frequently observed in the poor and wealthy than among the middle classes. It is predisposed to by poor, sordid and unhealthy surroundings, by lack of proper nourishment and life under severe mental strain or worry.

As exciting causes may be mentioned sudden mental or traumatic shock, fear, joy, grief, business reversal, prolonged illness, sexual excess and masturbation.

Pathology. Hysteria, being a purely functional disease, is characterized by no recognizable morbid change in the nervous system.

Symptoms. These occur in number and variety equaled by no other disease and comprise the symptoms of any of the other nervous affections. In the earlier stages the hysterical patient is irritable, emotional or despondent, magnifies every ill and is anxious for sympathy; he may give himself over to mirth or may indulge in attacks of weeping without apparent reason. His mentality may be more than usually active, although hysteria may occur in the mentally deficient. The general health may be of the most robust.

The hysteric convulsion may be preceded by manifestations such as those described above or such prodromata as vertigo, neuralgic pains, localized cutaneous anæsthesia or ovarian tenderness may be present. At times an aura resembling that of the true epileptic convulsion may be observed; most frequently this occurs as the *globus hystericus*, which is characterized by a sensation of choking as if there were obstruction of the trachea or œsophagus.

The most marked type of the convulsion (*hystero-epilepsy* or *hysteria major*) may be preceded by an aura, following which the patient may utter a cry, falls apparently unconscious and exhibits a tonic spasm; this is followed by the clonic stage and finally by relaxation and coma. The paroxysm is usually rather longer than that of epilepsy. The second stage of the attack is termed "clownism" by Charcot and is characterized by violent and exaggerated muscular contortions, emotional display or cataleptic poses. In the third period the patient assumes various attitudes expressive of ecstasy, happiness, terror or erotism. The fourth period, or that of return to consciousness, is characterized by delirious and hallucinatory manifestations in which the patient seems to see visions, hear voices and may converse with imaginary persons. These hallucinations may persist after the seizure is past.

In the minor form of convulsive seizure the prodromata may be similar to those described above; at the actual onset of the attack the patient falls, taking good care not to get hurt; the spasms consist of clonic muscular contractions which may involve all four limbs and even the trunk. The contractions are irregular and, although the patient seems unconscious, he gives the impression to the experienced observer that the condition is feigned. The convulsion passes in a few minutes or the patient may be aroused by the use of a strong galvanic shock or by dashing a small amount of cold water in the face. The seizure does not leave the patient in a somnolent or torpid state as does that of epilepsy.

During the non-convulsive stage the hysterical patient may exhibit symptoms referable to almost any organ or tissue of the body; these may be divided as follows:

Motor Symptoms. In addition to the convulsive movements of hysterical paroxysms the patient may simulate various forms of paralysis such as hemi-mono-, or paraplegia, tonic muscular spasms, contractures of the muscles of the extremities or of the neck, disorders of coördination or tremors. The paralysis is usually hemiplegic and more often on the left side, the face being seldom affected. Limbs apparently useless for locomotion may be moved while the patient lies in bed and if one leg is apparently paralyzed it is dragged shufflingly along while the other limb is taking ordinary steps, and is not swung outward as in true hemiplegia. Ataxia may accompany the paralysis which may be either spastic or flaccid. Vocal cord paralysis with loss of voice is not rare and may be demonstrated by laryngoscopic examination

which is particularly easy in hysterical patients, because of the anæsthesia of the pharynx, one of the stigmata of hysteric conditions.

The reflexes may be exaggerated, and the so-called hysterical joint may be observed. The latter is characterized by pain and swelling, of sudden onset, usually affecting the knee or hip. Motion is interfered with and in consequence muscular atrophy from disuse may ensue.

Contracture of the abdominal muscles may result in the so-called "phantom tumor." This is most frequently seen in the umbilical region and at times very accurately simulates a firm and solid growth. It is considered to be due to a spasmodic contraction of the diaphragm, the recti abdominis being at the same time relaxed, the vertebral column curved forward and the intestines distended. Pseudocyesis or false pregnancy is a variety of this condition. Such spurious tumors disappear if the patient is subjected to general anæsthesia.

Sensory Symptoms. Of these the most common are areas of cutaneous hyperæsthesia, anæsthesia or paræsthesia, the latter consisting of sensations of numbness or tingling, formication or of heat and cold. Symptoms referable to the organs of special sense may occur, such as mere lessened acuity of sight or diminution of the visual field. Other disorders are total blindness (never, however, hemianopsia) and loss of color sense. Deafness is not uncommon and loss of the senses of smell and taste is by no means rare.

Vaso-motor Symptoms. Paleness or blushing of the skin, as well as localized areas of coldness or heat, may be present. Œdema has been observed. Hæmoptyses and hæmatemesis may be alleged by the patient but in these patients the blood as a rule comes from the gums and then only in small amount. Hysterical hæmorrhages into the skin have been reported but must be most unusual.

Such secretory disorders as excessive or diminished perspiration, diminution or increase of the saliva and lessened or increased urinary excretion are frequently met, polyuria especially so, the urine being profuse in quantity, light in color and of low specific gravity. The urine in marked instances often undergoes further change, the urates and phosphates being diminished and the normal ratio (1 to 3) of the earthy to the alkaline phosphates being changed to 1 to 2 even 1 to 1; at the same time the urine is diminished in quantity. This change is considered by the disciples of Charcot to be a differential diagnostic point between convulsive hysteria and true epilepsy.

Digestive Symptoms. These are common and may consist of simple indigestion, gastralgia, perversions of appetite or flatulence.

Vomiting is frequent and may be voluntarily induced and œsophageal spasm resulting in dysphagia may occur. Constipation is frequent while diarrhœa is seldom seen.

Respiratory symptoms consist of the hysterical cough which occurs paroxysmally, is harsh and is accompanied by little or no expectoration; of dyspnœa

which may disappear upon diversion of the patient's attention, and obstinate hiccough.

Cardiac symptoms, such as arrhythmia, tachycardia or bradycardia and attacks of syncope, are not unusual.

Mental symptoms are prominent and variable. The patient is emotional, easily worried and excitable; the temper is irritable and hallucinations are frequent. True insanity may develop and rarely cataleptic trances have been observed.

Hysterical fever has been reported as reaching a temperature of 105 to 110° F. (40.5–43.5° C.) or even higher. Such a rise of temperature occurs irregularly and usually patients exhibiting this symptom are malingerers and in some way manipulate the thermometer; close watching usually results in their detection.

The prognosis in hysteria as regards life is good, fatal instances being rarely if ever seen. As regards recovery the prognosis depends upon the type of the disease in hand. Mild instances may recover within a few weeks, while others may go on for a number of years exhibiting intermissions and variations of the symptoms.

Treatment. Prophylaxis of the disease consists in combating all the influences mentioned in the section on ætiology as likely to be predisposing factors. Children, especially those of neurotic tendency or heredity, should be most carefully trained, they should be kept from association with hysterical persons and should be subjected to a proper system of training and education, self-control and denial being insisted upon, while over-indulgence and the gratification of every whim should be discouraged.

In the treatment of hysteria much depends upon the personality of the physician. He should be of firm character, insistent upon the proper fulfilment of his orders and at the same time sympathetic *within proper limits*. The milder hysterical manifestations seldom require much treatment other than that directed at the cause of the condition; this, in the mild type as well as in the more marked form of the disease, should be removed if possible. The patient's general physical condition should be carefully supervised and any abnormality corrected; at the same a regular and hygienic mode of life should be insisted upon, with proper diet, sufficient exercise and fresh air, and particularly should the patient be provided with some congenial occupation in which he is able and willing to engage. Tonics, especially arsenic and iron in moderate doses, are usually indicated. For the hyperirritability of the nervous system various sedatives may be prescribed such as the bromides, including monobromated camphor, asafœtida, castoreum, musk, chloroform, acetphenetidine, exalgine and the preparations of valerian. Hydrated chloral and morphine, if used at all, should be employed with the utmost caution.

The pains should be treated by means of the thermo-cautery and the galvanic current. Paralyses and contractures necessitate the employment of massage, manipulation and forced movements in connection with the electric current. Laryngeal paralyses may respond to electric treatment and anæsthesia to frequent applications of the faradic current. Paralyses and contractures of the limbs may persist despite anything that can be done. Hysterical vomiting may necessitate the employment of Debove's method of forced feeding (see p. 629).

The hysterical attack may be treated by sprinkling cold water in the patient's face or by flicking the face with a wet napkin, the flesh may be pinched vigorously, or it may be well, having seen that the patient is properly disposed of, to leave her, allowing her to emerge from the seizure and find herself alone, no one being present to offer sympathy. It has been suggested that pressure upon the epigastric region or over the ovaries will cause a cessation of the spasmodic manifestations. In spite of any rigidity of the abdominal parietes the pressure, if continuous and energetic, will often prove effectual. In the male pressure may be made over the same areas. A galvanic current of from five to ten milliamperes, one pole at the front of the body and the opposite behind, may be employed. Repeated sudden interruptions of the current increase its efficacy. Another method of treatment, which has the advantage of entire safety, consists in giving inhalations of amyl nitrite. This drug rarely fails to stop the seizure and has an excellent mental effect upon the patient. Æther and ethyl bromide may also be administered by inhalation but chloroform is hardly disagreeable enough to be of use. Capsules of æther which explode in the stomach are sometimes effective.

In marked types of hysteria no treatment excels that first advocated by Weir Mitchell. It is particularly indicated in those patients who are confined to bed. It consists in placing the patient entirely under the care of a competent nurse and if possible removing her from association with her family and sympathizing friends, and, while the treatment should be varied to meet the exigencies of each patient, its main details are as follows: The patient is kept absolutely quiet in bed, is not allowed to read or, at first, even to feed herself. Massage and electricity are employed for gradually lengthening periods, being omitted, however, during the menstrual epoch. A slowly interrupted faradic current is to be preferred to the galvanic. At first the diet is entirely of milk either skimmed or diluted with lime, barley or carbonated water in proportion of about 4 or 5 to 1; 4 to 6 ounces (120.0 to 180.0) are given every two hours, this quantity being gradually increased in accordance with the tolerance of the patient. If necessary the milk may be peptonized. After from seven to ten days, the milk being continued, solid food is allowed at midday. A chop or raw oysters with bread and butter or toast and a cup of cocoa or coffee make an acceptable luncheon and after some days a breakfast con-

sisting of an egg and a roll or a few biscuit is added. The patient should be given a sponge bath daily. In from four to six weeks the patient is allowed to sit up, a few moments at first, but as time passes, for longer periods and still later she is allowed to drive out and to take short walks. The latter are lengthened little by little until the patient is able to take considerable amounts of exercise without fatigue. The treatment should be carried out with the utmost regard for system and regularity, a schedule being made for the day, the hours for feeding, massage, electricity, exercise, rest, etc., being fixed. It is important that the patient should be allowed to rest for an hour after massage and the latter and electricity should never be given in close conjunction; an interval of two to four hours is not too great.

Most excellent results have followed this method of treatment particularly in thin, poorly nourished individuals.

Hydrotherapeutic measures are often of service in hysterical conditions, the nervous irritability responding particularly well to hot and cold packs. Hypnotism has been employed in the treatment of hysteria, especially in France, but while remarkable results have in numerous instances been achieved, most American writers unite in asserting that it should be used with the utmost caution if at all.

NEURASTHENIA.

Synonyms. Nervous Exhaustion; Nervous Prostration; The American Disease.

Definition. Neurasthenia is a functional disorder of the nervous system characterized by exhaustion of both the mental and physical energies of the patient.

Ætiology. The influence of heredity in this disease is well recognized, neurasthenia often occurring in those whose parents have been of neurotic or hysterical type or have lived the rapid, worrisome life that has become too common during the past three decades. Neurasthenia is more common in men than in women and results from over-work, attended with excessive mental strain or worry, as well as from the abuse of alcohol and tobacco, and the use of morphine. It occurs secondary to syphilis and the acute infectious diseases, particularly influenza; it may be caused by sexual excesses and perversions and by traumatism.

Pathology. No definite morbid change in the nervous system has been recognized as characteristic of neurasthenia.

Symptoms. These, in many instances, are similar to those of hysteria of the mild type but are varied, depending upon the organ or organs chiefly affected by the state of nerve weakness. In the cardiac form there are rapid and irregular heart action perceptible to the patient, and pain referred to the pre-

cordium. In the gastric type there are epigastric pulsations and sensations of distress after eating, with borborygmi. Vaso-motor manifestations, such as sudden hot flushes or sweats, may occur and the patient may suffer from vertigo or attacks of syncope. In another type of the disease the symptoms are referable chiefly to the nervous system and consist of muscular weakness, often so marked as to interfere with locomotion and the performance of ordinary acts with the hands and fingers, hyperæsthesiæ and paræsthesiæ and disorders of the special senses. The mentality may be affected and the patient suffers from low spirits, despondency or irritability of temper. Insomnia and mental confusion are not rare and the suicidal tendency may occur.

Sexual neurasthenia is not uncommon, the patient complaining of frequent nocturnal emissions, a dread of impotence, which may result in inability to perform the sexual act, and spermatorrhœa, the discharge of seminal fluid often accompanying micturition or defæcation. In males suffering from this type of the disease there are frequently pain and tenderness of the testicles; ovarian tenderness and menstrual disorders are frequently associated with neurasthenia in women.

Polyuria is frequently present, the urine being of light color and low specific gravity although patients in whom the urine is diminished in quantity and dark in color may be met. Purinæmic conditions are not infrequent complications of neurasthenia and this fact should not be forgotten when treatment is taken under consideration.

The prognosis is good in patients who are willing and financially able to undergo the treatment necessary.

Treatment. Prophylaxis consists in the attempt to so train children of neurotic inheritance and tendency that both the mental and physical forces may be conserved and rendered as resistant as possible. Over-indulgence is to be avoided and the child's food, school work, exercise and hours of sleep should be studiously regulated. Highly-strung and irritable children should be managed with great tact, the nurse or teacher should never lose her own temper while controlling the child and any excessive excitement or emotion is best managed by giving a warm bath followed by a sponge off with cool water. After this the child may be put to bed for a few hours and will usually go to sleep.

Prophylaxis in adults consists in the avoidance of excessive business worry and the leading of a regular life, particular attention being paid to exercise and sleep; frequent vacations may be advisable and it is often well, if the patient can arrange it, for him to take these under conditions totally different from those to which he is accustomed at home and away from sympathizing friends and relatives. The diet of the neurasthenic should be simple and nourishing and, if allowed at all, tea, coffee, tobacco and alcohol should be used in moderation.

Just as in the treatment of hysteria the physician about to take in hand a case of neurasthenia should seek to gain the implicit confidence of his patient. Naturally the ability to accomplish this object depends to a great extent upon the personality of the physician. The latter's visits, while regular, should not be too frequent and should be made at definite intervals. Much discretion should be used in responding to unnecessary calls from the patient. It is, perhaps, better to have an understanding with the nurse in this regard and to suggest that she use her discretion in transmitting such calls. The selection of a nurse is an important item. She should be a vigorous and robust woman and of a temperament as little nervous and emotional as possible.

The rest cure described in the section on the treatment of hysteria was first devised for neurasthenic patients and in many instances, especially obstinate and resistant ones in women or those complicated by drug habit, achieves excellent results.

Hydrotherapy is an efficacious form of treatment and, if about to employ it, the patient should be studied in order to ascertain whether his state is one of nervous excitation or of depression. In the former case the patient may not possess sufficient resistance to undergo a rigid course of bath treatment but will need to be strengthened by means of a systematic rest and diet cure before the hydrotherapeutic measures are admissible. In the ordinary type of neurasthenia the preferable mode of hydrotherapeutic procedure is the cold douche given but a short time and under considerable pressure. The jet should be applied in turn to all parts of the body except the head. Very excitable and emotional patients are benefited by the cold wet pack or half bath, followed by vigorous friction and exercise in order to produce a satisfactory reaction. If the cold douches impress the patient unfavorably the Scotch douche may be substituted. The douches are usually given twice a day, the patient being allowed to lie down for an hour or two after each.

Electric treatment is often useful in connection with hydrotherapeutic procedures. Galvanism or Franklinization associated with the high frequency current and general faradization may be employed. The Franklinic and faradic currents and the actual cautery may be employed in localized pain.

Patients able to travel are often greatly benefited by a sea voyage or a sojourn at one of the various spas where baths may be taken and mineral waters drunk. The latter frequently have an excellent mental effect upon the patient and the regular mode of life insisted upon at such resorts is beneficial.

With regard to medicinal treatment is may be said that while, as a rule, drugs should be avoided if possible, there are cases in which good results may result from their use. Tonics, especially if anæmia is present, are often indicated and of these those worthy of special mention are iron, strychnine and the arsenic preparations. Sodium cacodylate or iron cacodylate

may be given hypodermatically if the stomach is intolerant, the former in doses of $\frac{3}{4}$ of a grain (0.05) twice a day, the latter in doses of $\frac{3}{10}$ of a grain (0.02). The glycerophosphates may often be employed with benefit as follows: ℞ calcii glycerophosphatis, gr. ivss (0.30); sodii glycerophosphatis, potassii glycerophosphatis, magnesii glycerophosphatis, āā, gr. iss (0.10); ferri glycerophosphatis, gr. $\frac{3}{4}$ (0.05). Fiat chartula no. i. Sig. Take two such powders daily; or ℞ calcii glycerophosphatis, ʒiss (6.0); sodii glycerophosphatis, potassii glycerophosphatis, magnesii glycerophosphatis, ferri glycerophosphatis, āā gr. xxx (2.0), tincturæ kolæ, ʒiiss (10.0); syrupi aurantii corticis amari, q.s. ad ʒvi (200.0). Misce et signa one tablespoonful during breakfast and dinner.

The syrup of hypophosphites may also be prescribed or subcutaneous injections of sodium phosphate two parts, alcohol five parts, and distilled water 100 parts, may be given. Of the latter 15 to 45 minims (1.0–3.0) should be injected daily.

Another drug which has recently been much advocated is lecithin. It is given in pill form—$4\frac{1}{2}$ to $7\frac{1}{2}$ grains (0.3–0.5) daily—or hypodermatically in oily solution, each injection containing $\frac{3}{4}$ to $2\frac{1}{4}$ grains (0.05–0.15) of lecithin.

Injections of artificial sera have been recommended as a stimulant to the nervous system and to lower blood pressure. Such sera may be composed of phenol in crystal form 1 part, sodium chloride 2 parts, sodium phosphate 4 parts, sodium sulphate 8 parts, distilled water 100 parts, or sodium phosphate 10 parts, sodium sulphate 5 parts, sodium chloride 2 parts, crystalline phenol $\frac{1}{2}$ part, distilled water 100 parts. Of the former solution $2\frac{1}{2}$ drachms (10.0) may be injected daily; of the latter $1\frac{1}{4}$ to $2\frac{1}{2}$ drachms (5.0–10.0) twice a week. The solutions should be sterilized immediately before administration.

The treatment of cardiac symptoms: The application of cold wet compresses to the precordium or of the æther spray will relieve the palpitation or if this is a result of gastric disorder, treatment should be directed to the stomach. The bromides and the valerates may be indicated when this symptom is the result of nervous excitability. The systematic employment of hydrotherapeutic measures will tend to diminish the cardiac irritability.

Gastric symptoms should be treated according to the principles suggested in the sections on the treatment of neuroses of the stomach.

The pains and excessive nervousness may be allayed by the bromides or occasional doses of salipyrine, acetphenetidine or exalgine. For the sleeplessness a warm bath or a wet pack taken before retiring will often prove effectual. If drugs are necessary such mild hypnotics as sulphonethylmethane (gr. x—0.66), sulphonmethane (gr. xx—1.33) or veronal (gr. x to xv—0.66 to 1.0) may be prescribed at intervals. Morphine should never be allowed.

In sexual neurasthenia with nocturnal emissions and spermatorrhœa general treatment with attention to exercise and mode of life, together with the admin-

istration of hyoscyamus and the bromides, is to be advised. The loins should be sponged off with cold water or a cool sitz bath taken before retiring; no food should be eaten just before going to bed and the rectum should be kept empty to avoid pressure upon the prostate and seminal vesicles. The patient's mind should be kept occupied and off from thoughts upon sexual matters and he should be assured that he has greatly magnified his trouble and the possible consequences thereof.

The recent work done upon eye-strain renders it of paramount importance that any defect of vision should be properly corrected by the ophthalmologist.

THE NEURASTHENIA OF THE MENOPAUSE.

The incidence of the menopause (climacteric or change of life) is characterized in many instances by the appearance of numerous manifestations analogous to those of ordinary neurasthenia. The anatomical basis of these is undoubtedly a disturbance of the sympathetic nervous system. On no other ground can the symptoms be satisfactorily accounted for and on no other theory can the triad of pallor, flush and sweating, in whatever sequence they may appear, the tachycardia, the dyspnœas, the neuralgias, the vertigo, faintness, tinnitus aurium, headache, pruritus, the serous diarrhœas, the veritable downpour of urine and the varying mental moods be explained. At the menopause, the slowly increasing blood pressure of the inter-menstrual period which reaches its maximum at the onset of the flow, falls rapidly to its minimum at the termination of the period, going on in rhythmical cycle for about thirty years, is now disturbed; vaso-dilatation and vaso-constriction succeed and precede one another in irregular waves. Pathologically there is an actual insanity of vaso-motor function.

The majority of the patients who suffer from symptoms due to the menopause consult the specialist in internal medicine or the family physician. It is equally true that both these fully realize the importance of gynæcological operations and treatment and insist that their patients shall receive them should such be necessary; consequently it behooves the physician to be able to make a proper diagnosis of the condition. In accomplishing this object malaria, purinæmia and other general maladies, as well as diseases of the circulatory, alimentary and nervous systems, must be intelligently sought and excluded. Next, all local pathological conditions as determined by the gynecologist must be remedied. Having concluded that the symptoms are due to the menopause, we have immediate necessity for a working hypothesis which shall at once explain the manifestations of the condition and serve as a basis for a successful treatment. Such a one has been discussed above and as has been previously stated, the patient's state can best be accounted for by holding the sympathetic nervous system responsible.

Treatment. Disturbed balance of the sympathetic nervous system is most rapidly benefited by the use of the bromides. If the pulse is of good volume, tension and rate, sodium bromide in 15 grain (1.0) doses four times daily should be prescribed. If left ventricular hypertrophy exists the potassium salt in the same dosage should be given. If cardiac dilatation has supervened or arterial tension is lowered, the ammonium salt, the dose also being of the same size, is preferred. In the presence of dyspeptic symptoms or if prolonged administration seems likely to be necessary, strontium bromide is advisable. What the bromides accomplish with rapidity arsenic will achieve more slowly but with greater permanence, consequently as the condition responds to the former, the doses are diminished and arsenic is added, the solution of potassium arsenite (Fowler's solution) in 3 minim doses (0.2) after meals, being the most useful preparation. The dosage should be gradually increased until slight untoward symptoms arise, when the initial dose is resumed.

Since most of the patients are anæmic, iron, as iron and ammonium citrate, in dose of 4 grains (0.25) three times daily is advisable. The following combination of these remedies is suggested: Strontium bromide 1 ounce (30.0); solution of potassium arsenite 2 drachms (8.0); iron and ammonium citrate 2½ drachms (10.0); cinnamon water to 4 ounces (120.0). Of this mixture 1 teaspoonful (4.0) in a wineglass (60.0) of water is taken after each meal and at bed time. As the patient progresses toward recovery the amount of bromide is to be diminished while that of the arsenic is increased.

In some instances when cessation of the menstruation is speedily established, and particularly after surgical removal of the ovaries in young subjects, the administration of ovarian extract, 5 grains (0.33) thrice daily for one or two months is necessary; the dose should be gradually lessened. In other instances the vaso-motor disturbance may be more readily controlled by smaller—3 grain (0.2)—doses in connection with the bromides and arsenic. Such employment of ovarian extract is only exceptionally advisable.

For special indications further medication may be prescribed: (1) *Menorrhagia:* This may be controlled by absolute quiet in bed with ice bags over the hypogastrium. The fluidextract of hydrastis 30 drops (2.0) twice daily, or better, cotarnine hydrochloride, either by the mouth in 5 grain (0.33) doses in capsule, or hypodermatically in the same dose in a 10 percent. aqueous solution, is useful. A formula which is often effective consists of fluidextract of hydrastis 2 ounces (60.0); ergotine 2½ drachms (10.0); syrup to 5 ounces (150.0). Of this the dose is a teaspoonful (4.0) in a wineglass of water every hour or two. In rare cases tamponade of the uterus under thorough aseptic precautions may be necessary; more seldom it may be advisable to add 10 percent. of gelatin to the gauze, the latter being plain or impregnated with iodoform.

2. *Neuralgia.* This is best relieved by pills of monobromated camphor,

2 grains (0.13); quinine valerate 1 grain (0.065); extract of gelsemium (B. P.) 2 grains (0.13); extract of belladonna leaves $\frac{1}{5}$ of a grain (0.012) given four or five times daily. As an alternative pills of extract of belladonna leaves $\frac{1}{5}$ of a grain (0.012); extract of gelsemium (B.P.) 2 grains (0.13) and zinc valerate 3 grains (0.2) may be administered twice daily.

3. *Psychic Disturbance.* Sulphonethylmethane (trional) 15 grains (1.0) combined with heroine, $\frac{1}{12}$ of a grain (0.005) given at bedtime will tend to insure sleep during the night and quiet during the following day; or a suppository of dionine, $\frac{1}{2}$ grain (0.03), in cocoa butter may accomplish the same result. These prescriptions should be used only occasionally.

4. *Palpitation.* The tincture of veratrum in 15 minim (1.0) doses thrice daily to which may be added tincture of gelsemium 8 minims (0.5), is usually effectual.

5. *Constipation* is best remedied by the use of saline laxatives as Rochelle salt or such waters as Hunyadi Janos, Apenta, Rubinat Condal and the like. The other symptoms referable to the digestive tract are also benefited by the judicious use of salines.

6. *Diarrhœa* is usually of the nervous type and will yield readily to the bromides.

In the daily life of the patient, fatigue, wakefulness, sexual excitation, cold baths and especially sea bathing, spiced and highly seasoned food, tea, coffee and alcohol in all forms are to be avoided. In other words a quiet life from which all extraneous sources of irritation are removed is advisable. When it is remembered that at the menopause the mind of the patient is in a state of unstable equilibrium the importance of this last injunction is apparent. Rest, therefore, both physical and mental, is doubly essential. For exercise and to secure the necessary fresh air, daily walks in the open, but not to the point of fatigue, are suggested.

AMOK OR AMUCK.

This is a maniacal condition, seen amongst the Malay race, in which the individual affected runs through the streets in frenzy and with sword or other lethal weapon in hand slays or maims every one he meets until he meets death at his own hand or that of another. The disease as a rule attacks males and occurs in young adult life. According to the most recent studies the condition of Amok includes several states in which the affected individual commits violent, unthinking, unpremeditated and impulsive acts while mentality is blurred. Certain instances are classed as the insanity of adolescence, others as epilepsy, others under the rather indefinite term malarial psychosis, while still others are inexplicable.

Before the onset of the attack proper the patient for a number of days is

lethargic, stuporous or morose and sometimes amnesic. The exciting cause of the seizure is usually resentment at a real or imagined injury, loss of money, anticipation of disgrace or punishment on account of some misdeed, the sight or odor of blood or a marital grievance or infelicity. During the attack there is entire absence of memory which is an important point in the differentiation of this condition from that of latah.

The disease has been attributed to alcoholism, opium smoking and religious mania but while there is indubitably a religious element in some of the cases, the two former factors may be excluded.

It is the opinion of authorities that the individual who is "running amok" is not responsible for the acts committed during the frenzy.

ASTASIA-ABASIA.

Definition. A morbid condition in which the patient is unable to stand or to walk, while the sensation, muscular power and coördination of the limbs remain normal. The affection is an hysterical functional neurosis and has an ætiology similar to that of hysteria. It has been observed as a sequela of the acute infectious diseases and may result from nervous shock due to traumatism.

Symptoms. The symptoms typical of this condition are total or incomplete inability to stand or walk, while the limbs may be used in swimming and the patient is able to move them as he lies in bed. There is, in most patients, no disorder of sensation, no spasticity, no rigidity, the power or coördination is normal, and the muscles retain their normal strength.

In some instances the patient may be able to walk but the gait is somewhat spastic or ataxic, while in others the limbs may undergo sudden flexions or the patient may manifest a saltatory spasm.

The prognosis is that of hysteria of the ordinary type and the treatment is that of this latter disease, the rest cure and electricity being particularly indicated.

TRAUMATIC NEUROSES.

Synonyms. Traumatic Hysteria; Erichsen's Disease; Railway Spine; Railway Brain.

Definition. An hysterical or neurasthenic condition following nervous shock, particularly that due to sudden severe traumatism.

Ætiology. This affection may be the result of severe mental shock resulting from participation in, or even witnessing, railroad accidents, explosions, shipwrecks or other accidents. Even slight traumatisms, such as may result from a slip upon the pavement or stairs, may cause it.

Pathology. The morbid changes occurring in this disease are indefinite. Fatal cases are few but degeneration of the pyramidal tracts has been found after spinal concussion, and punctiform hæmorrhages in the brain and cord, sclerotic patches in the white matter and sclerosis of the cerebral vessels have been described.

Symptoms. In certain patients these are not markedly different from those of hysteria or neurasthenia due to other factors. Those referable to sensation are headache and backache, spinal tenderness, numbness and tingling in the extremities; hemianæsthesia, with achromatopsia on the anæsthetic side or contraction of the visual field, may occur. Motor symptoms of various degrees, fibrillary twitchings (Rumpf's sign) and even paralysis may be present. The reflexes may be exaggerated, differing in degree from time to time.

In severe instances with actual spinal concussion symptoms suggestive of organic disease of the nervous system may develop. These may appear early or may be gradual in their evolution and the accountable lesion has been found *post mortem* in certain cases in the shape of a pachymeningitis. The symptoms of such patients consist of pain in the head, back and other parts of the body, hemianæsthesia and areas of diminished cutaneous sensation and of tenderness, loss of temperature sense and of muscular sense, the latter being bilaterally symmetrical or irregular in distribution, disorders of smell and taste and diminution of the visual field with inequality of the pupils. Motor symptoms are of various types; monoplegia with or without consequent contracture, without atrophy and with persistence of normal electric irritability may occur with diminution of the cutaneous reflexes, the deep reflexes being increased. The mental symptoms are identical with those of marked hysteria.

Rarely in instances which have been primarily regarded as hysterical or neurasthenic, true organic changes evidenced by such symptoms as optic atrophy, bladder disturbances, increased reflexes, paresis and tremor, develop. Such may end in death, the organic changes being demonstrable upon autopsy.

The prognosis as regards recovery is good; few patients, however, are relieved while litigation is in progress; even after the decision has been rendered in the patient's favor the symptoms may persist but usually after the suit is terminated gradual recovery begins. Rarely patents grow progressively worse and melancholic symptoms develop, followed by dementia or paresis. In the instances in which organic changes develop, the prognosis is unfavorable.

Treatment consists in the employment of the methods and means suggested in the sections upon the treatment of hysteria and neurasthenia (pp. 819 and 841).

OCCUPATION NEUROSES.

Synonyms. Professional Spasm; Copodyscinesia.

Definition. This term is employed to designate a variety of nervous condi-

tions characterized by involuntary spasm or cramp of the muscles employed in performing some frequently repeated movement. The affection is seen most frequently in writers and here is denominated writer's cramp or scrivener's palsy; similar conditions occur in telegraphers, piano-forte and violin players, typewriters, milkers, seamstresses, cigarmakers and other tradespeople who continually perform the same muscular act in carrying out their occupations.

Ætiology. While occupation neuroses occur in those of phlegmatic temperament, they seem to be more frequent in those of neurotic tendency. Men seem to be more frequently afflicted than women though this may be the case because the male sex is more likely to be employed in occupations in which the condition develops. Writer's cramp is the most common type of occupation neurosis and, according to Gowers, it is seen more often in those who employ imperfect methods in writing, using the little finger or wrist as fixed points, whereas the elbow or forearm should properly remain stationary. Injury may precede the onset of the affection.

Pathology. No morbid changes typical of this disease have ever been described. Various theories, however, have been advanced to account for its occurrence. Of these the most probable is that the affection is a central one and is due to a disordered action of the nerve centers which control the muscular movements employed in writing. Atrophy involving the affected muscles is sometimes observed.

Symptoms. The first of these to appear is usually a cramp or spasm, chiefly involving the thumb and forefinger. The pen may be grasped too forcibly while the forefinger tends to slip off the pen, or the thumb may be flexed and adducted. A "lock spasm" may occur in which the pen can be removed from the grasp of the fingers only with difficulty. The hand feels weary and aching; pain, sometimes affecting the arm as well as the hand, may be present. The patient's grasp of the pen may be weak while the hand-grip remains normal. Tremor, most frequently of the index finger, may occur, sometimes as a precursor of atrophy. Numbness and tingling of the hand and forearm may be observed and if a true neuritis is present there is tenderness along the course of the affected nerve.

Marked instances may manifest such vaso-motor symptoms as glossy skin, a condition resembling that of chilblains or hyperæsthesia, while on an attempt to write the skin may become hot and cyanosed.

Electric reaction in the early stages remains unchanged but late in the disease the response of the motor nerve endings to faradism is diminished while that to galvanism may be increased.

The prognosis in marked types of the disease is hardly favorable as regards complete recovery although rarely this may take place. Patients exhibiting sensory symptoms are more likely to recover than others in whom these are lacking. Relapses are not uncommon.

Treatment. Prophylaxis consists in the acquirement of a proper technique in writing, as it is probable that if writing from the shoulder were in general use, cases of writer's cramp would be rare. The various appliances calculated to lessen the fatigue of writing are of little use, and invention of the typewriter has rendered all such unnecessary. Fortunately the affection does not interfere with the patient's ability to use this instrument. Learning to write with both hands is a way out of the difficulty unless both become affected with the disease; this unfortunate circumstance may occur.

Rest of the affected part is essential to a cure and as an adjunct, attention should be given to the patient's general hygienic condition. Fresh air and good food are necessities and, when indicated, the tonics, iron, arsenic, strychnine and codliver oil, should be employed.

Electricity may be prescribed with benefit, most authorities preferring the galvanic current; its use should be continued for months, a current of four milliamperes being sufficiently strong. The current may be applied every day or two for from five to ten minutes. Various methods of using the current have been advocated; the positive pole may be applied to the neck while the negative is placed in the supra-clavicular fossa,being at intervals moved to the skin over the affected muscles and nerves. The current may also be applied to the spinal column, or it may be passed through the head. If marked tremor is present the negative pole may be applied to the spinal region while the positive is placed over the nerves and muscles involved. An ascending current through the affected arm, the negative pole being on the forearm or ball of the thumb and the positive upon the neck, may be used. So many variations in the technique of the electric treatment are employed by different authorities that it seems safe to suggest that it is the fact that galvanism is used that achieves benefit rather than that a special method is effectual beyond any other.

A weak faradic current is indicated when paralysis and anæsthesia are present.

Hydrotherapeutic measures, massage and gymnastic exercises are useful, particularly the last. The most efficacious are those employed by Wolff. These consist of active and passive movements, the former are performed as follows: The fingers, hands, forearms, and upper arms are moved in every direction possible, effort being made to contract forcibly each muscle from six to twelve times. The exercise should last about half an hour, the patient pausing after the completion of each movement.

The passive movements are performed in the same manner and as each is made the operator offers opposition. Both active and passive movements should be repeated two or three times a day. Massage, consisting especially of percussion of the affected muscles, is given in connection with this treatment. Re-education similar to that advocated in the treatment of locomotor

ataxia produces good results. The patient is given systematic instruction in holding the pen and writing.

VASO-MOTOR AND TROPHIC DISORDERS.

RAYNAUD'S DISEASE.

Synonyms. Symmetrical Gangrene of the Extremities; Local Asphyxia.

Definition. A vascular disease due to a disorder of the vaso-motor system and characterized by three stages: (1) local syncope; (2) local asphyxia; (3) local gangrene.

Ætiology. The causation of this condition is indefinite and obscure. The disease occurs less frequently in men than in women and is more common in individuals in early adult life. Children may be affected.

Pathology. This also is not yet definitely determined. Raynaud suggested that vascular spasm is responsible. The asphyxia occurs as a result of dilatation of the capillaries and minute veins with spasm of the small arteries as an additional influence.

Symptoms. Of these the first remarked is a paleness of the affected part followed by loss of sensation and a marble-like whiteness. The condition simulates closely that due to exposure to cold and affects chiefly the fingers or toes, and is known as local syncope. It lasts varying lengths of time but usually for only an hour or so and may occur following a chilling of the extremities or emotional disturbance. As the reaction sets in the affected parts become hot, reddened and painful. This is the stage of asphyxia and may not affect all the fingers at the same time, one or more of the extremities may be purple and livid while the whiteness of the others persists. The ears and the tip of the nose may be involved in this state of asphyxia and more rarely the limbs, the skin over them assuming a characteristic mottled appearance. With the pain there may be swelling and itching. Chilblains may occur as a complication of this stage. The attacks may recur from time to time, being induced by exposure to cold or mental disturbances, disappearing under the influence of warmth; the parts involved, may, after successive attacks, become shrunken and indurated.

Few patients go on to the third stage, that of symmetrical gangrene. In such, this manifestation succeeds the stage of asphyxia, one or more of the fingers or toes becoming cold, dry and black in color, just as in dry gangrene. A line of demarcation is formed upon the skin, beyond which gangrenous blebs may form and finally there may be sloughing away of the dead tissue, although usually the loss of substance is slight. In rare instances symmetrical patches of gangrene make their appearance upon the limbs or body

and progress rapidly. Here the outcome may be fatal within a few days, especially when the condition occurs in children.

An associated symptom which may be met is hæmoglobinuria which may accompany the local manifestations or take their place; with this the urine may contain red blood cells and albumin.

Other symptoms which have been observed are stupor and partial unconsciousness, delusions, dimness of sight, urticarial and erythematous eruptions, scleroderma, cutaneous œdema and joint swelling which may result in enlargement of the finger joints and anchylosis. Peripheral neuritis may occur as well as symptoms of disturbance of the digestive system.

The prognosis as regards the preservation of life is usually good, weak and poorly nourished children, however, may succumb; those whose powers of resistance are good may outgrow the predisposition to the disease.

Treatment. All individuals subject to this disease should receive treatment calculated to improve their general condition, in the shape of tonics, proper diet, etc., and should avoid exposure to cold and mental irritation. During the attack the patient should be kept in bed and warmly covered, the limbs should be elevated and the fingers and toes wrapped in cotton, artificial heat being supplied in the shape of hot water bottles, if necessary. Rubbing the affected parts and the employment of galvanism and faradism are often beneficial. Placing the limb in warm salt water and applying one electrode to the spine while the other is put into the water has been recommended. Good results have been reported from the administration of glyceryl nitrate, gr. $\frac{1}{100}$ to $\frac{1}{50}$ (0.0006–0.0012) three times a day. The effect of this drug is to relax the vascular spasm and thus to improve the circulation of the part. Shutting off the supply of arterial blood of the limb by means of a tourniquet or an elastic bandage for a few minutes and then releasing the constriction will result in a reddening of the part owing to the relaxation of the vaso-motor tension and is said to be beneficial. This procedure, in severe types of the disease, must usually be frequently repeated in order to prove effectual.

For the severe pain salipyrine, acetphenetidine and antipyrine may be administered; this symptom, may, however, require the exhibition of codeine or morphine; the last must be given with caution.

ERYTHROMELALGIA.

Definition. A rare chronic disease characterized by pain, hyperæmia and rise of temperature in the part affected, this usually being one or both of the lower extremities. More seldom is the upper limb involved.

Ætiology. The causation of this affection is somewhat obscure. It

may occur with certain spinal cord lesions, and in diabetes mellitus. Arteriosclerosis seems to exert a certain influence in its incidence.

Pathology. The most constant morbid change is a chronic inflammation of the arteries of the affected part. Weir Mitchell, who first described the condition, suggests that it may be due to a neuritis of the nerve-endings while another theory that has been advanced is that the lesions may be due to irritation of the anterior horn cells of the cord.

Symptoms. These are first noticed in the ball of the foot or the heel and consist of pain varying from vague discomfort and sense of weight to extremely severe pain; swelling may appear later, especially after walking or standing. The skin is reddened, the veins are dilated and there may be visible arterial pulsation. Rest and elevation relieve the symptoms to a considerable degree. The condition is usually relieved by cool weather, but not in every instance.

The prognosis as to life is favorable but the patient may be subject to recurrences at varying intervals.

Treatment. An attack may be aborted by bathing the limb with ice water. The affected part should be kept elevated and compresses wet in cooling lotions should be applied. Intermittent hot and cold douches may be employed and the use of the faradic current and of systematic massage may prove beneficial. The pain may necessitate the administration of analgesic drugs. The patient's general condition should be cared for and tonics should be prescribed if necessary.

ANGIONEUROTIC ŒDEMA.

Synonym. Giant Urticaria.

Definition. A disease characterized by the sudden occurrence of transient localized œdematous swelling.

Ætiology. Heredity plays a definite part in the causation of this affection; it seems to be more common in females than in males in the United States, while the opposite is the case in European countries. It is more common in individuals of nervous temperament. Attacks may be induced by exposure to cold or by any influence which reduces nervous tone. The giant urticaria which occurs in digestive disturbances and in certain persons after eating strawberries, crabs or lobsters is probably a variety of angioneurotic œdema.

Pathology. This disease has been considered to be due to a neurosis of the vaso-motor system resulting in a dilatation and an augmentation of the permeability of the blood-vessels.

Symptoms. The most frequently affected region is the face; more rarely are the hands and genitals involved; the condition may occur, however, in any portion of the body even in the throat and pharynx. In the last situation symptoms of asphyxia result and death has been known to take place.

Digestive disturbances such as vomiting, colicky pains and diarrhœa, may be associated with the cutaneous manifestations. The area affected is small, as a rule being not over two or three inches in diameter, and varies in color from pallor to deep red; itching and burning sensations may be present but pain is rare. Periodicity has been noticed in the occurrence of the attacks and such associated symptoms as cardiac pain and hæmoglobinuria have been observed.

The disease is not dangerous to life except when there is involvement of the air passages, but often is very resistant to treatment.

Treatment. This consists in the employment of all measures which tend to improve the general condition of the patient such as tonics, especially those which affect the nervous system (phosphorus, the glycerophosphates, quinine and strychnine); in anæmic states arsenic and iron should be given and under all conditions the insistence upon proper diet and exercise in the open air is necessary. Hydrotherapeutic measures are often beneficial and hypnotism has been suggested. This last form of treatment should, however, be employed with caution. The local treatment consists in the application of a 10 percent. ointment of ichthyol upon compresses of gauze. The routine administration of glyceryl nitrate in doses of $\frac{1}{100}$ to $\frac{1}{80}$ of a grain (0.0006–0.0012) three times a day often produces excellent results. If, as has been suggested, the œdematous condition is due to an increased permeability of the blood-vessels, the treatment by dechloridation (elimination of sodium chloride from the diet) may be tentatively prescribed. When gouty, rheumatic or purinæmic conditions are present these should be corrected by appropriate treatment.

MIGRAINE.

Synonyms. Sick Headache; Hemicrania; Bilious Headache; Megrim.

Definition. A sensory neurosis characterized by headache, often unilateral, and sometimes by nausea and vomiting and visual disorders.

Ætiology. Heredity seems to exert a definite influence upon the causation of this disease. It occurs more frequently in women, especially those of nervous temperament, and not seldom in those whose general physical condition is excellent. Purinæmic states predispose to its incidence and the condition may be induced by eyestrain, menstrual abnormalities, mental and physical over-exertion and alimentary disorders. Predisposing causes are dental caries, and abnormal intra-nasal and naso-pharyngeal conditions. In chronic nephritis recurrent migraine is not uncommon.

Symptoms. The onset of the attack may be sudden or there may be prodromata such as dizziness, ringing in the ears, spots before the eyes and peculiar visions—the patient seeing imaginary animals, for instance. Temporary hemianopsia or scotoma may be observed. The pain soon makes its appear-

ance. It is usually frontal and on only one side although it may begin in the temple or occiput. From the original situation it extends to one-half or the entire head. In character it is continuous, sharp and boring. It is increased by noise and a bright light. The appetite is lost, there is marked nausea which may be followed by vomiting; the vomitus consists first of the contents of the stomach—partially digested food or mucus—and later of bile. If the vomiting takes place when the stomach is full the pain is often relieved. Vaso-motor manifestations, such as paleness of one side of the face which may be followed by marked redness, may be noted. Arteriosclerosis of the temporal artery on the affected side is not infrequent. The rate of the pulse is usually not accelerated.

The attacks tend to recur periodically and their duration is variable, lasting from one to three days. The disease is an obstinate one, although the prognosis as regards life is favorable. In certain instances the attacks, after having persisted from youth, have disappeared after the age of fifty has been reached in males, and after the menopause in females.

Treatment. This should depend upon the cause if this can be ascertained. The diet and mode of life should be carefully regulated. Some patients do well upon an entirely vegetable regimen. The bowels should be kept regularly open and any digestive derangement corrected. The eyes should be examined by a competent ophthalmologist and proper lenses prescribed if necessary. Intra-nasal and pharyngeal conditions should receive appropriate treatment. The urine should be examined for albumin and to ascertain if the excretion of uric acid is sufficient. Should the migraine be due to purinæmic conditions these should be treated (see p. 263). In anæmia the administration of iron and arsenic is indicated. In neurotic patients all emotional disturbance should be avoided.

The treatment by means of the bromides, especially potassium bromide, may prove effectual. This drug should be given in doses of 1 to 2 drachms (4.0–8.0) per day and continued if necessary for eight to twelve months. The point of toleration should be ascertained and the maximum dose given for six months; for the succeeding two to four months the dosage should be gradually diminished and at the end of about one year the drug should be stopped. When arterial hypertension is present glyceryl nitrate may be given ($\frac{1}{100}$ to $\frac{1}{50}$ of a grain—0.0006 to 0.0012). Here inhalation of amyl nitrite, 3 to 5 drops (0.2–0.33) may abort an attack.

In patients in whom the paroxysm is attended by marked nausea and vomiting a thorough gastric lavage followed by a saline purge, if employed as soon as any prodromata are noticed, may succeed as a preventive measure.

During the attack the patient should be kept in bed in a darkened room; the nausea may be relieved by a cup of strong coffee or by 20 to 30 drops (1.33–2.0) of chloroform. Hot or cold compresses should be applied

to the head. The treatment of the attack otherwise consists in the administration of various analgesics such as salipyrine, antipyrine, or acetphenetidine. The following formula may be recommended: ℞ acetanilidi, gr. iii (0.2); camphoræ monobromatæ, gr. ii (0.13); caffeinæ sodiobenzoatis, gr. i (0.065). One such powder may be taken every three or four hours. ℞ acetphenetidini, gr. viiss (0.5); sulphonmethani, gr. xv (1.0); three such powders may be taken during twenty-four hours. ℞ acetanilidi, sodium bicarbonatis, āā gr. iiss (0.16); caffeinæ citratæ, gr. i (0.065); extracti aconiti, gr. $\frac{1}{200}$ (0.003). One such tablet every three or four hours. Citrated caffeine alone in doses of 5 grains (0.33) or caffeine salicylate in the same dose may prove beneficial. This drug may also be given hypodermatically—caffeine sodiobenzoate, 5 to 10 grains (0.33–0.66). The extract of cannabis indica is considered by some to be the most effectual drug in the treatment of migraine. Its beginning dose is ¼ grain (0.016). This dosage is gradually increased and the administration of the drug may be continued for a considerable period. Aconitine (Duquesnel) may be employed in doses of $\frac{1}{4000}$ to $\frac{1}{2000}$ of a grain (0.00015–0.0003). When heart weakness is present strychnine should be given at the same time. This last drug is especially indicated in ophthalmic migraine. Tincture of gelsemium 10 to 20 drops (0.66–1.33) either alone or with ½ to 1 grain (0.032–0.065) of extract of cannabis indica may relieve the severe pain of an attack. Other drugs which have been advocated in the treatment of this condition are ergot and guarana. When the attack is accompanied by emesis it is usually best to administer medication hypodermatically or *per rectum*. If the pain is confined to the course of a certain nerve the overlying skin may be painted with a mixture of menthol, chloral and camphor. When less drastic measures fail a tape seton may be passed through the skin of the nape of the neck and allowed to remain in place for two or three months.

Electricity may be tried, preferably in the form of galvanism; one pole should be applied over the cervical sympathetic and the other to the nuchal region.

The employment of hydrotherapeutic measures, particularly as carried out at one of the various spas, may benefit certain patients, perhaps rather because of the enforced regularity of life than because of the baths themselves. A sojourn at Vichy, Carlsbad, Evian or at some of the similar resorts in this country may induce favorable results.

FACIAL HEMIATROPHY.

Synonym. Unilateral Progressive Facial Atrophy.

Definition. A rare affection characterized by a gradual wasting of the integument, fatty tissues, muscles and bones of one side of the face.

Ætiology. While this disease is obscure in its causation it is doubtless

due to a neurosis of the trophic functions. It is more common in females and may occur secondary to the infectious diseases and in syringomyelia.

Pathology. In the only autopsy in which the findings were such as to give evidence of the nature of the affection an interstitial neuritis of all the branches of the trifacial nerve in its terminal stage was found.

Symptoms. The disease usually begins in childhood but in rare instances may not appear until adult life. The atrophy more frequently affects the left side of the face though bilateral involvement and patients who exhibited atrophic areas on the back and arm of the affected side have been observed. At its inception the wasting may affect a definitely localized area upon the face or may be diffuse. The skin and subcutaneous tissues are first affected, then the bones, particularly those of the upper jaw, and finally the muscles, especially those of mastication. In the unilateral type the atrophy is distinctly limited at the mid-line of the face and the facial appearance is remarkable, giving the impression that the countenance is composed of two halves from different individuals. There may be hemiatrophy of the tongue and soft palate and the teeth may fall out as a result of the wasting of the gums and alveolar processes; the skin often changes in color and the hair of the affected side falls. The orbital fat is involved in the wasting process and the eye is sunken. Motor and sensory symptoms are rare but spasm of the facial muscles and disordered sensation may be present.

The disease is not dangerous to life but is of chronic course and little influenced by treatment.

Treatment consists in the regulation of the patient's mode of life in accordance with proper hygienic considerations and the systematic employment of electricity and massage.

MYASTHENIA GRAVIS.

Synonym. Asthenic Bulbar Paralysis.

Definition. A condition characterized by progressive muscular weakness, an increased susceptibility to fatigue and the presence of the myasthenic reaction of Jolly—a tendency on the part of the muscles to exhaustion when subjected to the faradic current.

Ætiology. In some instances the affection has been attributed to the presence of indol in the circulating blood. This substance acts as a poison upon the muscles and is considered to have a marked depressant action.

Pathology. No definite pathological changes have been described but in certain instances lymphoid infiltrations of the muscular tissue have been found.

Symptoms. The disease occurs chiefly in the young; the muscles of the eyes, face, and those of mastication and swallowing are first involved. Later

the affection spreads to the other muscles of the body. Walking may become difficult and a characteristic feature is a rapidly developing fatigue following the continued use of the muscles. Their power is, however, recovered after resting. The myasthenic reaction is a pathognomonic symptom. Dyspnœa may be present. The course of the disease is marked by remissions and recoveries have been reported, but death from exhaustion or dyspnœa is the rule. Strangulation while attempting to swallow has caused death. There are no atrophic changes; spastic manifestations and tremors are absent. Indicanuria may be present.

Treatment. If indolæmia is present, as evidenced by indicanuria, any tendency to intestinal infections should be corrected (see section on indicanuria). Mental and physical rest are essential. Electricity is contra-indicated, but massage may be employed. Strychnine and anti-syphilitic treatment may be prescribed. When disturbance of deglutition is present the patient may be fed by means of the nasal or stomach tube.

PERIODICAL PARALYSIS.

This is a rare and interesting condition which occurs in certain families or in isolated individuals. It is characterized by a suddenly appearing paralysis involving various groups of muscles.

It is probably due to autointoxication and in a number of patients a diminished excretion of kreatinine occurring shortly before and at the beginning of an attack, has been observed.

Symptoms. The disease may appear suddenly and without assignable cause in otherwise healthy individuals or prodromata in the shape of malaise and weakness in the parts to be affected may be noticed. The limbs, especially the legs, are chiefly involved in the paralysis, although paralysis of the entire body has been observed. The cranial nerves and the special senses escape. The reflexes are diminished or lost and faradic irritability of both muscles and nerves is absent. There is usually no febrile movement nor acceleration of the pulse although symptoms of acute cardiac dilatation may be present in some instances. After a few hours or days the paralysis begins to disappear rapidly and the patient quickly and entirely recovers. Recurrences are frequent, occurring at intervals varying from a day or two to two or three weeks. Seizures are rare after fifty years of age.

The paralysis is never permanent but patients sometimes die during an attack.

Treatment. The administration of the alkaline diuretics, particularly potassium citrate in doses of 20 to 30 grains (1.33–2.0) three times a day is said to prevent or shorten the seizures. This fact is perhaps in favor of the theory that the condition is due to the retention of toxic substances which should be excreted in the urine.

ADIPOSIS DOLOROSA.

Synonym. Dercum's Disease.

Definition. A rare condition characterized by the deposition of masses of fat in the subcutaneous tissue of various parts of the body. These masses are tender and painful.

Ætiology. The disease is one of women in the great majority of instances and has been considered to be the result of the early incidence of menopause and of atrophic changes in the thyroid gland. Its actual cause is unknown.

Pathology. The fatty deposits are denser than normal fat tissue owing to the more abundant connective tissue supporting framework. Atrophy and sclerosis of the thyroid gland have been observed and in one instance a tumor of the pituitary body was found. There may be degeneration of the cutaneous nerves with interstitial neuritis and the fatty tissue may contain hæmolymph glands.

Symptoms. As adult life progresses and the patient's adipose tissue increases it is noticed that the fat is unevenly distributed and that burning, shooting pains occur referred to the deposits of fat; these continue to increase in size and there is increasing weakness without signs of degeneration of the muscular system. Cerebration may become sluggish but there is no true mental disturbance. Irregular areas of hyperæsthesia or of anæsthesia may be observed and there is frequently loss of the patellar reflex.

The prognosis. The course of the disease is chronic and recovery appears to be impossible. Death occurs from some intercurrent affection.

Treatment. The administration of extract of the thyroid gland seems to lessen the severity of the symptoms in certain instances; it is given to the point of tolerance and may prove effectual. The pains should be controlled by the coal-tar analgesics, antipyrine, salipyrine or acetphenetidine; codeine may also be employed and, in cases of absolute necessity, morphine.

ACROMEGALY.

Definition. A chronic disease characterized by abnormal growth, particularly of the bones of the face and extremities.

Ætiology. The affection is rather more common in women than in men and usually begins between the ages of twenty and thirty years. Syphilis, rheumatism and the infectious diseases have been considered as predisposing to the condition but their influence in its incidence is not proven. In the light of recent research it is deemed probable that acromegaly together with gigantism and dwarfism, occurs as a result of a disordered function of the pituitary body.

Pathology. The bony hypertrophy is uniform and symmetrical; it affects both the shafts and extremities of the long bones; the maxillæ appear

increased in size due to enlargement of the antrum of Highmore; this, with a true hypertrophy of the mandible, causes the characteristic increase in the size of the face. In a very large percentage of the autopsies which have been made in this disease, involvement, usually hyperplasia, of the pituitary gland has been found which has led to the hypothesis that the affection is caused by a functional derangement of this structure and that the pituitary body presides in some way over skeletal growth and that the enlargement of the bones in acromegaly results from a hypersecretion of this organ. Persistence and enlargement of the thymus gland have been observed in certain instances as has also enlargement of the thyroid body as well as atrophy of this structure.

Symptoms. The head and face are much increased in size, the latter especially so; it is much lengthened as a result of widening of the alveolar processes and there is noticeable separation of the teeth. The lower lip may protrude, the neck seems to be shortened, the ears are prominent and the alæ of the nose together with the eyelids, are enlarged; the tongue may be thickened. The skin may be coarse, changed in color and moist but is not harsh, thickened and dry as in myxœdema. The bones of the limbs and especially of the hands and feet, are enlarged, the fingers and nails are broad and the hand possesses a spade-like appearance. The enlargement is symmetrical and there is no interference with function. The increase in size does not involve the legs and arms until late in the disease when there may be an augmentation of their circumference. The scapulæ, ribs, sternum and vertebral column may be affected, kyphosis being a not unusual late symptom. Muscular atrophy is sometimes present; the genitals may be enlarged. Headache and pains in the bones may occur, the patient is lethargic and cerebration is slow. The voice may be changed due to the lingual thickening and enlargement of the laryngeal cartilages and the special senses may be dulled. Ocular manifestations are frequent, a common early symptom being bitemporal hemianopsia. Optic nerve atrophy is frequent and neuritis may be noted. Menstrual disorders are not unusual and early menopause may occur. The patient may suffer from dyspnœa, palpitation and cardiac hypertrophy and there may be increased dulness over the *manubrium sterni* due to a persistent thymus gland.

The diagnosis is usually easy, the bony enlargement being general, not of the extremities of the bones only as in arthritis deformans or of the shafts alone as in osteitis deformans. Congenital progressive hypertrophy or giant growth affects one extremity or one side of the body only.

The prognosis is entirely unfavorable as to recovery but life is usually preserved for a long period unless terminated by intercurrent disease. Fatal instances of acromegaly have been observed which were probably due to pituitary neoplasm.

Treatment is unavailing. Thyroid extract gives no definite results and the same may be stated of extract of the pituitary gland. The headache and pain in the bones may be relieved by antipyrine or acetphenetidine.

LEONTIASIS OSSEA.

This is a rare disease characterized by an enlargement of the cranial bones and in some instances, of those of the face. The condition is the result of an hyperostosis due to a development of multiple osteophytes in the bones affected. In addition to the increase in the size of the bones, osteomata may appear upon the outer or inner surfaces of the cranial bones which sometimes may press upon the subjacent structures and give rise to the symptoms of tumor. The onset of the disease may occur in early life, sometimes following trauma. There is no known effective treatment.

OSTEITIS DEFORMANS.

Synonym. Paget's Disease.

Definition. A rare disease characterized by enlargement and softening of the shafts of the long bones and sometimes of those of the spine and cranium, those of the face being unaffected.

The changes in bony structure result in certain deformities such as a triangular shape of the head, the base being upward, and spinal curvature, more particularly a kyphosis in the dorsal or cervical region. The head is projected anteriorly and the legs may be bowed outward, anteriorly or posteriorly, the hips and lower thorax are widened and the abdomen becomes lozenge shaped.

Ætiology. The causation of the disease is unknown but the condition has been considered to have a possible relationship to acromegaly or osteomalacia.

Pathology. Microscopic examination of the bone structure reveals the presence of a rarefying osteitis associated with the formation of new bony lamellæ, some of the Haversian canals being wider than normal while others are contracted.

The symptoms consist chiefly of the deformities resulting from the bony enlargements.

Treatment appears to be vauleless.

HYPERTROPHIC PULMONARY OSTEOARTHROPATHY.

Definition. A condition characterized by enlargement of the bones of the hands and feet especially in the neighborhood of joints. Occasionally the ends of the bones of the forearm and legs are involved. The affection is usu-

ally associated with some pulmonary lesion such as chronic bronchitis, emphysema, tuberculosis, empyema, fibroid phthisis or neoplasm.

Ætiology. The causation of the affection is not definitely known. It is a disease of adults and has been attributed to the toxins of the pulmonary lesion which, being taken into the circulation, bring about an ossifying periostitis by their irritant action; other hypotheses are that it is due to circulatory obstruction and trophic nervous disorders or that the condition is a benign tuberculous inflammation.

Pathology and symptoms. The bones of the head and face are not involved. There is enlargement of the terminal phalanges and the nails are increased in size and curved over the finger ends causing the so-called clubbed fingers. There may be osteitis and thickening of the shafts of the long bones and joint effusions; spinal curvatures are rare but may result from direct extension of the pulmonary disease. Muscular atrophy from disuse may be present. The course of the affection is protracted and its development is slow although in occasional instances the evolution of the deformities is moderately rapid. Pain and tenderness are infrequently observed.

Treatment. The deformities cannot be influenced by medication. The chief indication is to combat the co-existing pulmonary condition by appropriate means.

SCLERODERMA.

Synonym. Dermatosclerosis.

Definition. A chronic condition characterized by local or generalized stiffening and induration of the skin.

There are two types of the disease; the diffuse and the circumscribed, the latter being also known as *morphœa*.

Ætiology. The circumscribed type is the more common and may be of trophoneurotic causation. The diffuse form is probably of similar origin and seems to be predisposed to by exposure and attacks of rheumatism. It may develop as a complication of exophthalmic goitre or in association with Raynaud's disease. Both forms occur more frequently in women and usually in middle adult life.

Pathology. There is no change in the epidermis; there is an increase in the connective tissue of the corium and an hyperplasia of the subcutaneous connective tissue probably resulting from arterial changes. The glands of the skin are not altered but there may be atrophy of the thyroid gland. In the diffuse form of the disease the cutaneous changes are general while in morphœa they are localized.

Symptoms. *The diffuse type of scleroderma* is rarer and more obstinate than the circumscribed. The skin of the extremities, of the face, of the chest

or of the neck is first affected; the skin becomes firm and tense and upon movement a peculiar stiffness is observed; later it becomes brawny and indurated and, while sometimes its normal appearance persists, it is more often smooth and glossy. Ultimately the skin becomes so hard and inelastic that flexion of the joints which are covered by the affected tissue is difficult or impossible. When the face is involved the expression is lost and the lips may become immobile. Cyanosis of the extremities may occur due to vasomotor disturbances and pigmentation resembling that of Addison's disease may be observed. When the condition is not general it tends to symmetry of distribution which the circumscribed type of the disease does not. The course of the affection is chronic, months often being required for its development. While it may persist *in statu quo* for years, at times it gradually disappears leaving no trace.

Sclerodactyly may be considered as related to scleroderma. Here the fingers become atrophied and their skin is thickened and glossy; the nails are distorted and pigment, ulcerations and excoriations may appear over the joints.

The circumscribed form or morphœa is characterized by the appearance of brawny, waxy patches upon the skin, usually of the breasts or neck, sometimes along the course of the nerves. Hyperæmia with pruritus may be an initial symptom, later there may be deposition of pigment or entire loss of coloring matter (*leucoderma*). The patches often develop and spread with rapidity and there may be sensory disturbances. While the cutaneous manifestations may persist for only a few weeks, at other times they remain for years; ultimately, however, they usually disappear.

Treatment. The only medication that seems to exercise any effect over the condition is thyroid extract. Instances have been reported in which much benefit was derived from its administration. It may be necessary to continue its use for years. Tonics should be given, iron, codliver oil and especially arsenic. The salicylates and phenyl salicylate in doses of 10 to 15 grains (0.66 to 1.0) three times daily have been recommended and the use of the galvanic current upon the lesions has been advised.

The patients should be kept warmly clothed and protected from exposure. Warm baths and massage of the affected parts with bland oils or, in protracted and obstinate instances, with oil of turpentine well diluted with olive oil should be employed to lessen the stiffness of the skin.

AINHUM.

Definition. A trophoneurosis characterized by the development of a furrow in the digito-plantar fold and finally resulting in amputation of the toe.

Ætiology. This disease affects the dark skinned races almost exclusively. It is not infrequent in Brazil, India and Africa and has been observed in the

United States. Traumatism may act as a predisposing factor. No specific cause is known.

Pathology. Microscopically a constricting band of fibrous tissue is seen about the base of the toe; this gradually becomes tighter, the member swells, becomes disintegrated without suppuration, and finally falls off.

Symptoms. The little toe is most often involved. The furrow is first seen upon its inner aspect, increases laterally, becomes deeper, the toe swells and burning pain may extend to the foot or up the leg. Finally the swelling disappears and the toe is spontaneously amputated leaving a dry scab behind. Constitutional manifestations are wholly wanting.

The prognosis is favorable as regards recovery although the process may persist for a number of years.

Treatment is entirely surgical. Early in the affection the constricting band should be severed. After the toe has degenerated amputation will hasten recovery.

CHAPTER XI.

DISEASES OF THE MUSCULAR SYSTEM.

MYOSITIS.

INFECTIOUS MYOSITIS.

Synonym. Suppurative Myositis.

Definition. An acute or subacute inflammation of striped muscle due to an infectious agent.

Ætiology. The disease has been observed most frequently in Japan and seems in most cases to be due to infection with the staphylococcus pyogenes aureus, while more rarely the albus is found co-existing or the streptococcus seems to be responsible for the condition.

Pathology. The distinctive lesions seem to be firmness, brittleness and fatty degeneration of the muscles involved, serous infiltration and hyperplasia of the inter-muscular septa. Abscesses may be present in the substance of the affected muscles and an irregular erythematous rash is often seen.

Symptoms. The muscles of the limbs are more usually affected but those of the body and the heart muscle may participate in the infection. The onset of the disease is usually sudden with marked febrile movement and prostration. There is swelling of the muscles with slight œdema and an erythematous rash upon the body and limbs. There is pain in the muscles, motion increases this symptom. Paræsthesiæ may occur in lieu of the pain. Later, abscesses, with their ordinary symptoms, may form in the substance of the muscles and pyæmia may follow.

Instances have been reported in which atrophy of the affected muscles occurred but these may have been instances of acute progressive muscular atrophy.

The disease has been called pseudo-trichinosis from its resemblance to that affection.

The course of infectious myositis lasts from one month to a year or more.

Polymyositis Hæmorrhagica is the name given to form of myositis differing little from the preceding except for the fact that during its course hæmorrhages between the muscle fibres occur and circulatory symptoms resulting from involvement of the heart muscle are observed.

OSSIFYING MYOSITIS.

Synonym. Myositis Progressiva Ossificans.

This is a rare disease characterized by a calcification of the muscles. It is seen most often in males and is likely to begin about the age of puberty. Its course is very protracted and finally most of the muscles may become involved. The process begins with fever and swelling and redness of the muscles affected; induration persists after the acuity of the condition has disappeared and the indurated areas are finally transformed into bony substance. Entire muscles may become ossified. Theories advanced to account for the process are that the bone development originates from the periosteum or that the bone develops according to Cohnheim's law of fœtal inclusion and is a true osteoma. Traumatism seems to be an exciting cause.

Treatment. This consists, in all varieties of myositis, in relieving the symptoms as they arise. The abscesses in the suppurative type should be opened and drained and the bony growths of the ossifying form may be excised if necessary.

MUSCULAR DYSTROPHIES.

PSEUDO-HYPERTROPHIC PARALYSIS.

Synonyms. Lipomatosis Luxurians Muscularis; Atrophia Musculorum Lipomatosa.

Definition. A paralytic condition of the muscles associated with atrophy which is obscured by hyperplasia of the interstitial fatty tissue.

Ætiology. Heredity is the only recognized causal factor and is of considerable influence. The disease is one which affects children chiefly and boys more than girls. It is usually transmitted through the mother although she may not have been herself afflicted. It is often seen in several successive generations and may occur in several individuals in the same generation. It usually develops before puberty but may appear as late as the twenty-fifth year or beyond that age.

Pathology. The nervous system is seldom affected, the chief lesion being in the muscles themselves. The muscle fibres first are increased in size, their nuclei become more numerous and the connective tissue is increased. Later the muscle fibres atrophy and become fissured, the connective tissue becomes much hypertrophied and there is marked increase in the fatty tissue between the muscle fibres.

Symptoms. The symptoms of the paralysis appear before the evidences of the pseudo-hypertrophy. The child is unsteady upon his legs, the movements are clumsy, especially so in jumping and in ascending stairs. Examination

reveals what seems to be an enlargement of certain muscles; the pseudo-hypertrophy being especially evident in the calves and later in the extensors of the leg, the glutei and the lumbar muscles; those of the upper extremity are seldom affected save the deltoid and triceps. Walking becomes difficult, and the characteristic waddling gait with shoulders thrown back, abdomen protruded, and the lumbar lordosis accentuated, is evident; the nates are prominent and the feet far apart. As the legs are raised the feet drop because of weakness of the dorsal flexors of the foot. A very characteristic symptom is elicited by placing the child on the floor and bidding him to rise. He first gets on all fours, rises to his feet by drawing his arms along the floor and assumes an erect position by climbing his own legs by drawing the hands up the limbs until one knee is reached, then with this as a vantage point he raises the body, then grasping the other knee forces himself into the erect position.

Palpation reveals the fact that while the size of the muscles is large their consistency, instead of being normally firm, is soft and flabby. True atrophy of some muscles, especially of those of the arm, without the replacement of their lost substance by fat, may be present.

There is no sensory disturbance, the sphincters are not affected and the mentality is usually unimpaired. The electrical irritability of the muscles is less acute than normal because of the loss of muscle substance but the reaction of degeneration is absent; the knee jerk is sometimes lost and there may be mottling of the skin, especially over the legs.

The prognosis is grave, the patient seldom living to grow up.

JUVENILE MUSCULAR DYSTROPHY.

This type of dystrophy is less frequent than the preceding affection and occurs in slightly older subjects although found as a rule before the age of twenty. Heredity plays the same part in its ætiology as it does in that of pseudo-hypertrophic paralysis. The disease begins usually in the arms and shoulders and involves the pectorales, trapezius, latissimus dorsi and triceps; later the glutei, the quadriceps extensor, the peronei and tibialis anticus are affected. More rarely the latter muscles are first attacked; the muscles of the hands and feet are not affected although muscles of the limbs other than those mentioned may finally participate in the disease, and certain groups are likely to be the subject of a true or pseudo-hypertrophy. When the serratus is involved there is a projection of the scapula which is quite typical.

The gait is waddling and locomotion may finally become impossible. Bulbar symptoms are rarely seen; the atrophy, however, may involve the diaphragm and cause death. The course of the disease is protracted, Erb giving thirty-eight years as its longest limit, and the prognosis is distinctly unfavorable.

MUSCULAR DYSTROPHY OF THE LANDOUZY-DEJERINE TYPE.

This affection is also termed Juvenile Palsy of the Facio-scapulo-humeral Type and is hereditary in the same sense as are the two preceding diseases. It may begin as late as the thirtieth year of life and is characterized by a muscular wasting involving primarily the facial muscles. The eyes cannot be entirely closed and phonation, whistling and laughing are difficult. The facial expression (*facies myopathique*) is characteristic, the eyes being partly closed, the cheeks hollowed and the upper lip dependent (the tapir mouth). There are no fibrillary contractions and the electrical reaction is unchanged. The masseters and temporals, the internal muscles of the eye and those of the forearm and hand are not affected.

MUSCULAR ATROPHY OF THE PERONEAL TYPE.

This form of muscular atrophy begins late in childhood or even after puberty. Heredity is a factor in its causation and it is met more often in males. The muscles on the anterior surface of the leg, the extensor longus hallucis, extensor communis digitorum and the peronei are first involved; pes equinus or equino-varus may result; the calf muscles may become affected later in the disease and after many years those of the hands and forearms. Fibrillary contractions are present and the reaction of degeneration and various sensory and vaso-motor disturbances may occur, the affection thus differing from the previously described types of muscular dystrophy.

In this disease peripheral nerve degeneration and ascending degeneration of the posterior columns of the cord have been made out *post-mortem* and in view of these findings the condition may be considered as the result of a neuritis. Its course is chronic and little can be done in the way of treatment other than to correct the deformities by means of apparatus or operations.

The treatment of the various types of muscular dystropy is most unsatisfactory but the measures suitable in progressive spinal muscular atrophy (see p. 757) may be employed. The general health should be considered, exercise in moderation prescribed and massage of the affected muscles with oil is indicated. Electricity may be beneficial. After the patient becomes bedridden, care should be taken to prevent contractures and bed-sores.

CHAPTER XII.

PARASITIC DISEASES.

PSOROSPERMIASIS.

The *psorosperms*, *sporozoa* or *cytozoa*, are classed among the lowest forms of the *protozoa*. These organisms are very common in the invertebrates and are not very rare in mammals. Of the psorosperms the *coccidium oviforme* or *cuniculi* and the *coccidium hominis* are the most important. The former produces in the rabbit a condition characterized by the development of whitish nodules in the liver which vary in size and are due to circumscribed dilatations of the bile ducts. In man a similar condition (**Internal psorospermiasis**) may result in which there may be hepatic tenderness with chills, fever, prostration, stupor and finally coma; the nodules in the liver are sometimes palpable. After death whitish growths have been found in the peritonæum, pericardium, liver, spleen and kidneys.

The parasites have also been observed in the kidneys, ureters and intestine. In the former instance frequent urination of bloody urine has been noted and obstruction of the ureter with resulting hydronephrosis has been described. Intestinal psorospermiasis causes gastro-enteric irritation with increasing prostration until the patient may lapse into the typhoid condition.

External psorospermiasis is said to occur and is characterized by a hard, crusty, papular eruption upon the face, abdomen, lumbar region and groin; later the papules tend to become confluent. The sporozoa are found in the cutaneous lesions in this form of the condition as well as in those of cutaneous carcinoma and Paget's disease. Whether these organisms have any relation to the causation of these latter is undecided. In so-called dermatitis coccidioides bodies resembling psorosperms have been found to be blastomyces.

Psorosperm infection reaches man upon such vegetables as spinach, lettuce, cabbage, etc., which are eaten uncooked and are liable to contamination by the excreta of lower animals in which the affection occurs, consequently the condition may be in great measure prevented by proper attention to the cleaning of green vegetables.

Treatment. The injection of 1 to 1000 to 1 to 5000 solution of quinine has been suggested but it can hardly be effectual unless the medicament comes into contact with the parasite in the intestine. The treatment of psorospermiasis is otherwise symptomatic.

Other protozoa which cause disease in man are the *amœba coli* and the *plasmodium malariæ*. These have been considered in the section upon the infectious diseases.

DISTOMIASIS.

Synonym. Trematodiasis.

Different forms of distomata or flukes are found in various situations in the human body.

Distomiasis of the liver is due to infection with one of the *liver flukes* (*Distomata*). These organisms are of the family *Fascolidæ* of which five species have been found in the human system. The most common is the liver fluke (*fasciola hepatica*) which inhabits the bile passages of ruminants, and particularly those of the horse, rabbit, sheep, goat and ass. The eggs of the fluke escape in the intestinal evacuations of these animals and under favorable conditions embryos extrude from these ova which are ingested by snails where they undergo further development and are finally cast off to attach themselves to certain water plants and, with these, are eaten by animals.

Symptoms. When present in large number in the human bile ducts the flukes cause an irregular diarrhœa which at first may be bloody, the liver is enlarged and jaundice may be evidenced at intervals. The patient may complain of pain; there is seldom any marked febrile movement. The affection is a chronic one and finally anæmia and emaciation appear with ascites and general œdema. Temporary amelioration of the symptoms may take place but permanent recovery is very rare, the disease ultimately resulting fatally. An endemic type of hepatic distomiasis occurs in Japan from which children are the chief sufferers. The ova are easily demonstrated in the fæces.

Treatment consists in combating the symptoms as they arise. Phenyl salicylate in large doses, male fern and naphthalene have been suggested.

Pulmonary distomiasis due to the *distoma pulmonale* or lung fluke is occasionally observed. This form of fluke has been found in the lungs of the pig, dog, cat, and tiger. It is believed to enter the human body with drinking water and is a parasite 8 to 16 mm. in length, 4 to 6 mm. in width and 2 to 4 mm. in thickness. The most typical symptom of its presence is hæmoptysis which may be mistaken for a manifestation of pulmonary tuberculosis; there is also an intermittent cough with sputum resembling that of infectious pneumonia. Cerebral metastases may occur with paroxysms of Jacksonian epilepsy. The eggs, which may be found in the sputum, are dark brown, thick-shelled, operculated and are from 80 to 100 μ long and from 40 to 60 μ broad.

The prognosis of the condition depends upon the general condition and

age of the patient, the presence of complications, especially pulmonary tuberculosis, and the number of the parasites in the lungs.

Prevention of this condition may be accomplished by boiling drinking water and destroying the ova in the sputum by disinfection.

Treatment is symptomatic.

Distomiasis of the blood or *Bilharziosis* is the result of infection with the *blood fluke* or *Bilharzia hæmatobium* (*schistosomum hæmatobium*). This organism is a narrow worm, the male being from 4 to 15 mm. long, while the female, which is generally carried by the male in a gynæcophorous groove, is longer, being about 20 mm. in length. The blood fluke is common in Egypt and other parts of Africa and is believed to effect entrance through the skin of persons who bathe in the rivers in which it is present in great numbers, and upon drinking water or upon infected food such as edible water plants.

The males with the females seek the bladder and rectum; the latter lay their eggs in the tissues but these travel to other parts, some being discharged with the urine and fæces while others which are retained produce irritation, and connective tissue changes and sometimes vesical and rectal papillomata; in other instances they become the nuclei of calculi.

Symptoms. The blood flukes may cause no serious disturbance, at times being present for long periods without resulting harm; usually, however, their presence is associated with perinæal discomfort, vesical irritability, pain on urination and bloody urine; when the parasites are harbored in the rectum there is tenesmus with stools containing mucus and blood; rectal ulcerations and papillomata may result in marked infections. The ova may be found in the discharges from both bladder and rectum.

Such complications as vesical and renal calculi, perinæal fistulæ and periurethral abscesses may occur. The loss of blood may result in a moderate degree of anæmia. There is a distinct eosinophilia with a corresponding diminution in the number of polymorphonuclear leucocytes in the blood.

The parasites may reach the portal and mesenteric veins but in these situations cause no especial symptoms although a thickening of the tissues about the portal vessels (Glissonian cirrhosis) is said to occur at times.

The affection is chronic in its course and as stated may not result in serious damage. Upon the incidence of other infections, especially in children, the symptoms may disappear.

Prevention of the entrance of the fluke into the body consists in avoiding possibly infected water and food and not bathing in the rivers of infected districts.

Treatment. The employment of the extract of male fern has been suggested although there is no known method of destroying the parasites in the blood. The hæmaturia, rectal and vesical inflammations, should receive

appropriate treatment and the other symptoms should be combated as they arise.

Intestinal Distomiasis. A new variety of blood fluke, the *schistosoma cattoi*, has lately been described, the eggs of which are smaller than those of *schistosoma hæmatobium*, brown in color and do not possess the typical spinous extremity. This parasite is said to inhabit the blood-vessels of the digestive tract and to cause intestinal ulceration. The ova are found in the stools of the infected individual.

The *fasciolopsis Buskii*, the *mesogonimus heterophyes* and the *gastrodiscus hominis* may be found in the small intestine. The first and the last occur in British India and the *mesogonimus* has been observed in Japan and Egypt.

NEMATODES.

ASCARIASIS.

Ascaris lumbricoides (the round or maw worm) is one of the most common human parasites and is found in all parts of the world. Its habitat is the small intestine. It is most frequently observed in the young but is not rare in adults. Usually not more than six or eight are found in one host but instances in which more than a hundred have occurred have been reported. Its body is round, tapering at either end and is marked with transverse striations. It is yellowish or brownish in color; its diameter is about that of a common goose-quill, the male being from four to eight inches (10 to 20 cm.) in length while the female is eight to twelve inches (20 to 30 cm.) long. At the oral extremity the worm possesses three lips, each supplied with fine denticulations, while the caudal end terminates conically, being curved ventrally in the male and straight in the female. The eggs are ellipsoidal in shape 50 to 75 μ by 40 to 58 μ, thick-shelled and covered with an albuminous envelope; when found in the stools they are stained yellowish from the fæcal matter.

When discharged in the intestinal evacuations the ovum slowly develops in water or moist earth and is taken into the body with food or drinking water; the embryo, which has up to this time been enclosed by the envelope of the egg, is now freed by the action of the juices of the alimentary tract and grows to the adult stage within four or five weeks.

The parasites usually remain in the small intestine but may migrate. They have been found in the vomitus, in the fæces, in the bile ducts and in the pancreatic duct. Collections of them may cause intestinal obstruction and they may wander to the mouth, nasal passages, into the air passages when they may cause asphyxia or pulmonary gangrene, or into the Eustachian tube and cause

perforation of the tympanic membrane. They frequently migrate into the rectum.

Symptoms. The ascarides may give rise to no suspicious manifestations but their presence is usually associated with intestinal irritation and resulting colicky pain, dyspepsia, nausea, vomiting and diarrhœa; reflex symptoms such as restlessness, disturbed slumber, headache, vertigo and even epileptiform and choreic attacks may be observed. Salivation, itching of the skin, especially at the nostrils, and anus, lachrymation, swelling of the lachrymal papillæ, dilatation of the pupils and mental disturbances may occur.

Complications referable to the presence of the parasite in unusual situations have been noted. Among these are jaundice, due to bile duct obstruction, intestinal obstruction and symptoms of asphyxia. The worms have been found in perforative appendiceal and perinæal abscessess and in inflamed herniæ.

The diagnosis can be positively made only by demonstrating the presence of the worms themselves or by finding the ova in the fæces.

The prognosis is wholly favorable unless complications arise.

Treatment. Prevention consists in abstention from the use of possibly contaminated food or water.

The most efficient anthelmintic in ascariasis is santonica which is preferably administered in the form of santonin. It may be given in divided doses either mixed with powered sugar or sprinkled upon bread and honey or jelly; for a child of five years three doses of 1 grain (0.065) each at intervals of four or five hours are usually sufficient. Lozenges containing santonin are not to be commended for they often fail to dissolve. The bowels should be freely evacuated by a saline cathartic or calomel shortly after the patient has taken the final dose of the vermifuge or the latter may be given with calomel, 1 grain (0.065) of santonin to 1 or 2 (0.065–0.13) of the mercurial. Untoward effects such as yellow discoloration of the urine or yellow vision (xanthopsia) may follow the use of santonin but they are neither permanent nor serious.

Sodium santoninate should not be employed since most instances of santonin poisoning have been due to this salt.

Spigelia is also a popular remedy for the round worm and is best employed in the form of the unofficial fluidextract of spigelia and senna, the dose for an adult being 2 to 4 drachms (8.0 to 15.0); for a child of two years ½ to 1 drachm (2.0 to 4.0) should be prescribed.

Chenopodium is considered an excellent vermifuge in ascariasis and is particularly indicated in the presence of intestinal inflammation since it not only expels the worms but also appears to benefit the irritation in the alimentary tract. The ordinary dosage of the oil of chenopodium is 3 minims (0.2) which may be administered in capsules, emulsion or dropped upon lump

sugar. The dose is usually repeated three times a day before meals, for two days, when a cathartic should be ordered.

Oxyuris vermicularis (the pin-, thread-, or seat-worm) is a very common parasite and one of almost universal distribution. It occurs most often in children but adults are sometimes infected; large numbers are usually present. The parasite very closely resembles a short bit of white thread, the male being about $\frac{1}{6}$ of an inch (5 mm.) long and the female about twice this length. The oral extremity is supplied with a mouth possessing three retractile lips. The tail tapers to a point. In color the worm is white. The eggs are oval, flat upon one side, thin-shelled and colorless and about 50 μ by 16 to 20 μ.

The oxyuris inhabits the lower end of the ileum and the cœcum. They wander freely, more usually downward to the rectum or even into the vagina but sometimes upward even as far as the stomach whence they may be vomited. When large numbers are present in the intestine they may form balls with the mucous secretion of the gut; they may be discharged with the fæces and the irritation which they cause often produces a chronic catarrh of the colon.

Infection is believed to take place as follows: The ova with the developed embryos inside are passed in the fæces and become scattered over vegetables and fruit, which later are to be used as food, here they may remain for considerable periods without perishing. The eggs also attach themselves to the tissues and hairs about the anus and, being removed thence by the fingers of the patient, may be transferred to his mouth or contaminate substances which he may handle and thus infect other individuals. The possibility of the ova being transferred from fæces to food by flies has also been suggested. Water is said not to transmit the infection for the ova quickly perish in this medium. After the ingestion of the eggs the worm reaches the adult stage in about two weeks.

Symptoms. The most characteristic and common of these is anal pruritus which generally appears soon after the patient retires at night; at this time the parasites migrate and often appear at the anal orifice. The itching is often extreme and the irritation caused by the presence of the worms in the intestine may result in the production of a catarrhal colitis with the exudation of a considerable amount of mucus. The rectal irritation also causes anal prolapse, frequency of urination, urinary incontinence, balanitis in the male and vulvovaginitis in the female; the latter may also be produced directly by the entrance of the parasites into the vagina. The genital irritation may induce the habit of masturbation. Nervous manifestations are more rare than with other species of intestinal parasites but chorea and convulsions have been observed.

The diagnosis. The worms may be seen at the anus, to which attention has been directed by the complaint of itching; they may also be found in the fæces, in which the eggs are likewise present.

The prognosis under proper treatment is entirely favorable although the condition is often obstinate.

Treatment. The parasites in the intestine above the rectum may be destroyed by the means suggested for the round worm but the most effective method of treatment is that by rectal enemata. Preliminary to the medicated injection the rectum should be cleared of fæcal matter and mucus by means of an enema of lukewarm water containing 1 drachm (4.0) of borax to the pint (500.0). After the bowel has relieved itself of this solution an injection consisting of ½ a pint (250.0) of 1 to 10,000 mercury bichloride in warm water should be administered. The injection should be given through a soft catheter passed high into the bowel and it should be retained as long as possible. The procedure should be repeated every other night until the parasites and their eggs have disappeared, an enema of saline solution (0.9 percent.) being given upon the alternate evening.

Cleanliness of the parts about the anus is an absolute essential, for no matter how much care is exercised the patient is likely to contaminate his fingers by scratching and despite our best endeavors will often re-infect himself by transferring ova to his mouth. After each defæcation or even oftener the anus and perinæum should be sponged off with 1 to 10,000 mercury bichloride solution, the anal folds being separated by means of the fingers to insure perfect contact of the solution to all parts. On retiring, the anus may be anointed with a little mercurial ointment or an ointment composed of 1½ drachms (6.0) of mercury bichloride to an ounce (30.0) of vaseline.

Injections, the patient being in the knee-chest position, of solutions of other substances are often efficient; of these an infusion of quassia—½ pint (250.0) of the preparation, 1 to 100 with *cold* water, to avoid extraction of too much of the bitter principle—is often employed. Infusion of asafœtida, aloes or garlic, as well as mixtures containing tannic acid, vinegar, oil of eucalyptus and camphor, may prove useful. An infusion of garlic, with large amounts of this substance taken by mouth, may destroy the parasites after the failure of the more ordinary means.

Ascaris alata (*ascaris canis*, *ascaris mystax* or round worm of dogs and cats) is a slender whitish or brownish parasite, the male from 1 to 1½ inches (40.0 to 60.0 mm.) long, the female about three times this length. The tail is rolled into a spiral and upon either side of the head there is a wing-like projection. The mouth possesses three denticulated lips. The ova are nearly spherical and from 68 to 72 μ in diameter. They are contained in a thin albuminous envelope. The life-history of this parasite is analogous to that of *ascaris lumbricoides*. The *ascaris alata* is only occasionally found in man.

The symptoms and treatment are similar to those of the ordinary round worm.

Trichocephalus dispar (*ascaris trichiura* or whip-worm). This parasite is about 2½ inches (4 to 5 cm.) in length and possesses a body of rather remarkable form, the anterior two-thirds being extremely thin and hair-like, while the posterior one-third is thick and, in the male, obtuse and rolled into a spiral; in the female it is straight and terminates in a blunt conical point. The ova are oval and dark brown, their long diameter being about 0.05 mm.

Great numbers of this worm are often found in the cœcum and colon. It is quite common in Europe but is infrequent in the United States. The symptoms are not characteristic and even if the host harbors large numbers of the parasite he may exhibit no suspicious manifestations although anæmia and diarrhœa are sometimes associated with the presence of the worm. The diagnosis may be made by finding the eggs in the fæces.

Eustrongylus gigas (*dicotophyme gigas*) is one of the largest of the nematodes, the male being about 1 foot (30 to 40 cm.) in length while the female is about three times as long. Its color is reddish and the cephalic extremity possesses a six-lipped orifice bearing papillæ. The ova are elliptical, thick-shelled and brown, their longer diameter being 64 to 68 μ. This parasite is found in the dog and other animals; it is rare in man. Its habitat is the pelvis of the kidney; as a result of its presence this structure becomes dilated and the kidney may become reduced to a hydronephrotic sac in which the parasites are found surrounded by bloody urinous fluid. The presence of the worm is demonstrable only upon autopsy. The diagnosis rests upon the demonstration of the eggs in the urine. The parasite can be removed by surgical operation only. Up to the present time only one kidney has been found involved in a single individual.

Anguillula aceticí (the vinegar eel) is said to have been found in the urine but its presence is more probably due to the fact that a dirty bottle has been used to collect this secretion. The *anguillulina prutrefaciens* or onion anguillula, which lives in this vegetable, has been found in vomited fluid.

Strongyloides intestinalis. These are small nematodes which are commonly found in the fæces of the epidemic diarrhœa of tropical countries. They probably have no especial influence in the causation of the affection but when present in large numbers may keep up the intestinal irritation of a dysentery due to other causes. The parasites infest all parts of the intestinal tract and may force their way into the bile and pancreatic ducts. The worm is frequently found in Indo-China, East India, Africa, Europe and South America; it has been observed in the United States in a number of instances. It causes no marked symptoms but, when present in large numbers, may produce anæmia. Stool-disinfection is necessary as a preventive measure and the worms may be destroyed by the administration of the extract of male fern.

Acanthocephala (*thorn-headed worm*). One or two instances of human infection by the *gigantorhynchus* or *echinorhynchus gigas* have been reported as well as one of *echinorhynchus moniliformis*. In the intestine of the pig the gigantorhynchus is common, the intermediate host being the cockchafer or the June bug.

ANCHYLOSTOMIASIS.

Synonyms. Uncinariasis; Hook-worm Disease; Brick-maker's Anæmia; Miner's Anæmia; Egyptian Chlorosis.

Ætiology. The train of symptoms to which the term hook-worm disease has been applied is the result of infection with two types of parasite, the *anchylostomum duodenale* of the old world and the *uncinaria Americana* of the western hemisphere. Hook-worm disease has been recognized since the time of the ancient Egyptian writers but its connection with the *anchylostomum duodenale*, which was discovered in Milan by Dubini in 1838, was not proven until within comparatively recent years.

The hook-worm is generally distributed throughout tropical and sub-tropical countries, being very common in Egypt and frequent in the Philippines, Porto Rico and in the mining regions of Germany, Austro-Hungary and England. In the United States no authentic instances of uncinariasis were recognized as such until 1893. In 1902, Stiles, to whom we owe great credit for his work upon this subject, showed that the disease was very frequent in many parts of the country and that to hook-worm infection most of the anæmia which was so common in the Southern States was due. An anchylostomum, the *uncinaria Americana*, is the specific parasite.

Both the *anchylostomum duodenale* and the *uncinaria Americana* possess the same general morphological characteristics. The male is about $\frac{1}{3}$ of an inch (1 cm.) in length while the female is slightly larger, being about $\frac{1}{2}$ an inch (12 to 15 mm.) long; the length of the foreign worm is slightly less than that of the native variety. The *anchylostomum duodenale* is whitish in color or flecked with brown spots posteriorly if the intestine contains blood; there are transverse striæ. The body tapers toward the head which is curved upon the dorsum in the form of a hook. The head is provided with seven curved teeth. The tail of the male is abruptly pointed while that of the female is more tapering and finely pointed. The eggs are ovoid in shape, colorless and thin shelled, their long diameter being from 50 to 60 μ.

The American hook-worm has no hook-like teeth upon the oral rim but is supplied with a large ventral and smaller dorsal chitinous lip upon either side, and a larger and more prominent dorsal conical tooth. The ova are similar to those of *anchylostoma duodenale* but are larger being from 68 to 70 μ in the longer diameter.

The parasite inhabits the duodenum and jejunum; the eggs are passed in the fæces and liberate their embryos in water or moist earth; these develop into larvæ which may live for an indefinite length of time in the mud or water, to be finally taken into the stomach upon drinking water, food which is contaminated by the dirt under the nails or upon the hands or with earth which is deliberately eaten. In other instances the larvæ may enter the body through the skin and finally reach the intestine where they develop into the adult parasites, suck the blood from the intestinal wall, produce minute hæmorrhages, and, presumably, produce a substance which acts as a poison. The sucked blood provides nourishment for the worm and upon autopsy the parasite is found embedded in the mucous or submucous wall of the intestine and the intestinal lining shows ecchymoses open at the centre.

The infection is most frequent in rural districts where sand abounds and in individuals who come into close contact with the damp earth, such as miners, excavators, brick-makers, etc. Whites seem to be more prone to severe infections than negroes and the most marked types of the disease occur in women and young persons. Several instances in one family are often observed.

Symptoms. These may be obscure in the mild type of the infection; in medium grades of the disease the anæmia is more or less marked and in the extreme instances the affection is characterized by extreme anæmia and œdema. The period of incubation (the stage of the disease before the ova appear in the stools) is from four to ten weeks and may be characterized by irritation of the gastro-intestinal tract. In some regions where uncinariasis is common the fæces of a considerable proportion of the comparatively healthy children contain ova.

In the advanced stages of the infection there is more or less lack of bodily development; the skin is waxy white or yellowish; hair is present upon the scalp but is not abundant upon other parts; the breasts and external genitals are poorly developed; the facies is anxious and sometimes œdematous; the conjunctivæ are pale and lachrymal secretion is often diminished; the mucous membranes are of poor color and the tongue may be marked with purple or brownish spots. The cardiac apex beat is often visible and there may be cervical pulsation; the abdomen is prominent as a result of hepatic and splenic enlargement and the presence of ascites. The extremities may be œdematous and sluggish ulcers may be present. There is no characteristic febrile movement, in fact, the temperature may be subnormal. Dyspnœa is not rare, there may be palpitation and hæmic murmurs are frequently audible. The appetite may be either diminished or increased and there is often a desire for unusual foods such as salt, pickles, coffee, sand or clay. Either constipation or diarrhœa may be noted. Such nervous manifestations as headache, vertigo, mental hebetude and stupidity are common. There is emaciation with marked

muscular weakness. The urine often contains albumin; casts are rarely found.

The blood shows a varying degree of anæmia, both the hæmoglobin and the number of red corpuscles being diminished. The leucocytes may be slightly increased or diminished. An important characteristic is the presence of eosinophile leucocytes. These are said to be found in over 90 percent. of the cases.

The diagnosis is easily made by finding the ova in the fæces; if the microscope is not available a very simple and accurate test may be performed as follows: Place an ounce (30.0) of fresh fæces upon a piece of white blotting paper and allow it to stand for twenty to sixty minutes; remove the fæces and examine the color of the stained paper. In 80 percent. of the cases of uncinariasis of medium or severe grade the stain is reddish-brown and suggestive of blood. In making this test the presence of hæmorrhoids should be excluded. The occurrence of eosinophilia is an important diagnostic sign.

The prognosis is favorable save in advanced instances of the disease. Without proper treatment the duration of a single infection has been, in one case, followed for six years and seven months (Stiles); how much longer it may last has not been shown. If the patient is subjected to re-infection the disease may continue for fifteen years or even longer. Fatalities are not very rare in severe and prolonged infections which have not received proper treatment.

Treatment. Uncinariasis may be prevented to some extent by disinfection of fæces, by thorough washing of the hands, after having to do with earth or water which may contain the uncinaria, and by boiling all drinking water.

The most efficient anthelmintic in uncinariasis is thymol; this drug is best administered as follows: After having placed the patient upon fluids (milk and soup) for three days, 30 grains (2.0) of thymol are given at 8 A. M.; at 10 A. M. the dose is repeated and two hours later a purge is given, preferably a saline; castor oil dissolves thymol and the solution of this agent within the body may cause toxic effects; for the same reason alcohol should not be given with the thymol as has been recommended. After a week the stools should be examined and if ova are still present the treatment should be repeated until they disappear but it is better not to administer thymol oftener than once a week. It is very important to be certain that no eggs are to be found in the fæces before discharging the patient as cured.

Thymol carbonate has been suggested as a substitute for thymol but probably offers no advantages over the former drug; male fern is also advocated.

The treatment of the anæmia is that of secondary anæmia from other causes (q. v.), iron and plenty of nourishing food in connection with other tonics being indicated. It is considered best to omit the iron upon the days when thymol is given (Stiles).

TRICHINIASIS.

Synonym. Trichinosis.

Trichinosis, the term applied to infection with the *trichina spiralis* is acquired by eating the meat of infected hogs. The parasite is cylindrical in shape, the length of the male being about $\frac{1}{16}$ of an inch (from 1.4 to 1.6 mm.); the anterior extremity tapers to a point while the posterior extremity is thickened and bifid, each lateral appendage being somewhat conical. The length of the female is about three times that of the male and the tail is rounded. The larvæ when born are from 90 to 100 μ in length, blunt anteriorly and pointed at the caudal extremity. Muscle trichinæ, the encysted larvæ, are about 1 mm. long and 0.04 mm. in thickness, tapering anteriorly but obtuse posteriorly; they lie coiled in an ovoid capsule which is at first transparent but becomes opaque as a result of calcareous infiltration.

In the adult sexual stage the *trichina spiralis* inhabits the intestine of man and other animals, such as the hog, rat, mouse, guinea pig, rabbit, cow, sheep, horse, dog, cat, etc. The parasite is also found in the hen, duck and pigeon. In the intestine of its host the trichina gives origin to a great number of larvæ, after which the adults perish and the larvæ migrate to the inter-muscular tissues and finally into the substance of the muscles where they develop in about fourteen days into the mature muscle form, setting up, during the process, an interstitial myositis and ultimately becoming encysted in an oval capsule which may contain from one to four of the coiled larvæ. The cyst wall is transparent at first and about 0.4 mm. by 0.25 mm.; the capsule gradually thickens and becomes infiltrated with calcium salts, this process taking place in from five to eight months and sometimes involving the larva itself. The encysted larvæ may live within the muscle of the hog for eleven years and in that of man for as long as forty years.

The human being usually acquires trichiniasis by eating infected pork which has been cooked insufficiently to destroy the parasite. In the intestine the capsules of the encysted larvæ are dissolved by the digestive secretions and their contents is set free. In the intestine they develop into the adult worm in about three days. After fertilization has taken place the males perish while the females, adhering to the intestinal mucosa or penetrating the wall of the gut, migrate to the mesentery or the lymph glands of this structure. Each female is capable of giving birth to a great number of larvæ which leave the intestinal tract in the lymph current and find their way to the muscles either in the blood stream or by direct migration.

Trichiniasis is most common in Germany where the use of raw or imperfectly cooked pork in the form of sausage is frequent. Pickling or smoking infected meat is not effective in destroying the parasite but *thorough* cooking will accomplish this object. In the United States the disease is somewhat

rare, Stiles, who has made a special study of the subject, stating that up to 1898 not more than 900 instances have been reported. It is probable that many instances of the affection are undetected for many of the reported instances were unsuspected, the parasite being revealed after autopsy, death having occurred from other causes.

Pathology. The morbid changes are chiefly in the striated muscle fibre and consist of a localized myositis characterized by granular degeneration and nuclear proliferation. The cysts are present in the muscles, appearing to the naked eye as small grayish oat-shaped bodies placed longitudinally in the muscular fibres, and the adult parasites may be found in the intestine. Enlargement of the mesenteric glands and fatty degeneration of the liver have been observed. Important blood changes occur and will be considered later.

Symptoms. The presence of trichinæ in the intestinal tract may not be followed by the disease, for the parasites may be passed off by the bowel before they have had time to mature and reproduce themselves; also the migration of only a few larvæ may not be characterized by noticeable symptoms.

Following the ingestion of numerous trichina larvæ symptoms of gastro-intestinal irritation may appear within three or four days; there may be nausea, vomiting, abdominal distress and diarrhœa; general malaise with prostration and pains in the bones and muscles may occur. These prodromal manifestations may be wholly absent or, on the other hand, so severe as to be mistaken for cholera morbus. The invasion of the disease takes place in from a week to ten or even fourteen days; it is usually characterized by a rise in temperature to 103° to 104° F. (39.6° to 40° C.); the temperature curve is of remittent or intermittent type and is seldom associated with chills. In mild types of the infection there may be no fever. The migration of a large number of larvæ in the muscular tissue, as stated above, causes a myositis which is evidenced by muscular pain, increased upon pressure and active and passive movement, and swelling, with cutaneous œdema, appearing first in the eyelids and later in the extremities and trunk. This symptom may last several days and disappear, to recur after a week or less. The involvement of the muscles of the jaws, throat and larynx may result in painful and difficult mastication, deglutition and phonation, while the myositis of the diaphragm, thorax and abdomen is accompanied by dyspnœa and painful respiration. Sweating and cutaneous pruritus are not uncommon and urticarial and other eruptions have been observed. Nervous symptoms, such as headache, sleeplessness, pupillary dilatation and transient loss of the tendon reflexes, sometimes occur. In prolonged instances of the disease emaciation and anæmia are noted. Increased urine and albuminuria have been common in certain epidemics.

The patient, in instances of very severe infection, may fall into the typhoid state, with its typical manifestations.

The blood usually exhibits a varying degree of leucocytosis and, what is much more important and characteristic, a marked eosinophilia, the number of eosinophiles being in direct proportion to the severity of the infection.

The diagnosis of sporadic instances presents certain difficulties on account of the resemblance of the disease to enteric fever and muscular rheumatism, but if a number of patients are stricken at once with characteristic symptoms, particularly after possible exposure such as an occasion where many persons have partaken of ham or sausage, suspicion should at once be excited. Differential blood counts should be made immediately and the intestinal mucus, a mild laxative having previously been given, should be examined for the parasites which may be seen with a low power lens as small, glistening, thread-like bodies. The dyspnœa, muscular pains, tenderness and swelling, and the œdema are important diagnostic signs. If the diagnosis is doubtful bits of muscle should be removed from the deltoid or pectoralis major, under cocaine or other local anæsthesia, and examined microscopically. A special instrument has been designed for the excision of the muscular tissue.

The prognosis depends upon the number of larvæ which have been eaten and upon the number of adult parasites which develop in the intestinal tract. In the milder infections recovery is usual within two weeks; marked gastro-intestinal irritation is considered to augur well for the patient. In severe instances of the disease the illness may be protracted for two months or more and is followed by a very slow convalescence. The death rate varies in different epidemics from 1 to 25 or more percent.; the fatal issue may occur as late as the sixth week.

Treatment. The prevention of trichiniasis consists in the inspection of the carcasses of all hogs slaughtered for food and in the destruction of those found infected. The importance of clean surroundings for their stock should be explained to those who raise swine for market and also the necessity of proper feeding. While it is not certainly known how hogs become infected it has been suggested that the infection may be transmitted from the rats which thrive about abattoirs, consequently the destruction of these animals in slaughter-houses and about pig styes is advisable. Finally, complete prophylaxis may be achieved by the thorough cooking of all ham and sausage.

If the patient is seen early in the disease, free evacuations of the intestinal contents should be secured by means of large doses of calomel (followed by a saline), rhubarb, senna, aloin or other purgative, with the object of freeing the bowel from the parasites there present. With the purges, anthelmintic drugs, such as santonin, male fern or thymol, should be given. It is important that the bowels should be kept freely open for at least a week after infection has taken place. Glycerin in doses of a half ounce (15.0) every hour has been

recommended. We know of no means to destroy the larvæ within the muscles, but the use of picric acid in doses of from 5 to 8 grains (0.33 to 0.5) has been suggested.

The treatment otherwise consists in the employment of measures calculated to relieve the symptoms. The muscular pains may be relieved by means of hot baths or applications of anodyne liniments, equal parts of hydrated chloral, camphor and menthol, for instance, with hypodermatic injections of morphine should these become necessary. The restlessness and sleeplessness may be controlled by the bromides, sulphonmethane (sulphonal), sulphonethylmethane (trional) and similar drugs. During the febrile stage the diet should consist of nourishing fluids and, upon the establishment of convalescence, tonics, such as strychnine, quinine and iron, with massage and electricity to combat the excessive muscular weakness, are indicated.

FILARIASIS.

A number of different filariæ claim man as their host. Of these the most common are the three species which are included under the term *filariæ sanguinis hominis*.

1. *Filaria Bancrofti*, the most frequently found blood filaria, occurs in most tropical regions. It has been observed in East India, China, Japan, the Malay Archipelago, the South Sea Islands, Australia, Africa, and the West Indies, as well as in the Southern United States. The male parasite is about $1\frac{1}{4}$ inches (4 cm.) in length and $\frac{1}{300}$ of an inch (0.1 mm.) in thickness; the anterior extremity is slightly clubbed, the posterior extremity tapering and spirally twisted. The female is brownish, about twice the length and thickness of the male and possesses rounded extremities; the ova are 38 μ by 14 μ. The embryos measure from 270 to 340 μ in length by 7 to 11 μ in breadth; their especial peculiarity is that they are found in the blood at night only, except in the case of individuals who sleep during the day, when they are present in the circulation during the hours which the host spends in sleep.

2. *Filaria diurna* is found in the blood during the waking hours only and is to be differentiated from *f. Bancrofti* by this fact and the absence of granules in the axis of the larva. Manson who first described this form of filaria suggests that it is the larval form of *filaria loa*.

3. *Filaria perstans* is also known only in its larval form and is found at all times, day or night. The embryos are smaller than those of the preceding varieties, being about 200 μ in length. They are actively motile and have an abruptly rounded and truncated posterior extremity; the anterior extremity is retractile and possesses a prominent spicule. This parasite is possibly the cause of *craw-craw*, an ulcerative skin eruption which occurs in west Africa.

F. Bancrofti is the most important of the above described parasites and to its presence in the human body *hæmatochyluria* and *elephantiasis* or *lymph scrotum* are attributed.

The embryo filariæ enter the blood stream by means of the lymphatics and, being no larger in diameter than the thickness of a red blood cell, are easily passed through the finest capillaries; although enclosed in their sheaths, they are actively motile and may be easily seen in specimens of fresh blood. During the day they are not found in the blood except in very exceptional instances or when the patient is accustomed to sleep in the daytime and work at night. At night they are present in the blood stream in great numbers.

The life-history of the parasites is not very definitely known but it is supposed that they are withdrawn from the circulation by the mosquito. The larvæ develop to some extent in the stomach of the insect and then migrate, finding their way into the thoracic muscles. Upon the death of the mosquito the larvæ are set free in the water in which the insect has died, this is drunk by human beings, according to the older theory, and the larvæ entering the digestive tract, bore through its walls into the lymphatic vessels. The larvæ have been found in the proboscis of the mosquito and the more probable method of transmission is by means of the bite of this insect and consequent direct infection.

Symptoms. Large numbers of filariæ may be present in the blood without giving rise to suggestive manifestations or prejudicing the health of the host; on the other hand certain pathological effects may be produced.

Hæmatochyluria. If the parasites cause stoppage and obstruction of the lymph circulation a lymph fistula may open into the ureter or bladder and the urine becomes milky (*chyluria*) from the admixture of chyle and if, as a result of the development of this fistulous opening, there is a rupture of blood-vessels, blood also appears in the urine (*hæmatochyluria*). Without other symptoms or marked disturbance of health, the patient passes at intervals opaque milky urine which may show an admixture of blood. The urine is otherwise normal in its constituents but at times may be increased in amount. In the intervals of the chyluria the urine is of ordinary character. The passage of the chylous and bloody urine may be associated with lumbar pain. Under the microscope the milky urine is seen to contain fat globules, red blood cells, and sometimes motile filariæ.

Lymph Scrotum, Lymph Vulva and certain types of elephantiasis may result from the presence of the filariæ. The affected parts are swollen and thickened and contain plainly visible and distended lymph vessels; these are found to contain a milky, turbid or blood-stained fluid which coagulates on standing. Filariæ are sometimes present in the fluid. The inguinal and femoral glands may be swollen and soft. Erysipelas infection of the affected tissues may occur and may be accompanied by chills, fever and sweating.

In connection with the conditions described above, blood changes, such as anæmia and eosinophilia, splenic enlargement and interference with general nutrition, have been observed.

Treatment. The prevention of filariasis is, to some degree, possible by boiling the water used for drinking and in the preparation of food, by destroying mosquitoes and by preventing the access of these insects to human beings by means of bed screens, etc.

There is no certain method of destroying the filariæ in the body although good results have followed the administration of thymol in doses of 1 to 5 grains (0.065 to 0.33) given for a period of several weeks; benzoic acid, sodium benzoate and methylthionine hydrochloride (methylene blue) in 4 grain (0.25) doses have been recommended by certain observers. Chyluria necessitates temporary confinement to bed, an avoidance of fluids and fats, and the administration of saline purges to lessen the tension in the lymphatic system. Such treatment may result in the temporary disappearance of the chyle from the urine. If fats are omitted from the diet the urine may continue normal but the administration of a glass of milk is often followed by a recurrence of the turbid urine, proving that the lymphoid fistula is still patent.

The surgical removal of the adult parasites from the inguinal or other accessible glands is often of pronounced benefit and is unattended with danger.

DRACONTIASIS.

Synonym. Guinea-worm Disease.

Filaria or **dranunculus medinensis** (*The Guinea-worm*) is a common parasite in the tropical and subtropical parts of Asia, Africa and America. The female only has been observed; it is whitish or yellowish in color, from 20 to 28 inches (50 to 80 cm.) in length and from $\frac{1}{6}$ to $\frac{1}{2}$ an inch (0.5 to 1.7 cm.) in thickness. Its anterior extremity is rounded and is supplied with a two-lipped oral orifice. The tail tapers to a blunt point bent into the form of a hook. The male is believed to be much smaller. The larvæ are supposed to enter the alimentary tract of the host in drinking water, being enclosed in the bodies of certain small arthropods (cyclops) or free, having gone through several stages of development inside this latter organism. The theory that the parasites may enter the body by penetrating the skin has also been suggested. Probably the male and female are ingested but the former dies after having performed the function of impregnation, while the female, containing a very large number of embryos, penetrates the intestinal wall, and migrating to the subcutaneous tissues, still further develops. It may remain quiescent and is palpable under the skin; later the parasite finds its way downward through the tissues to the ankle or foot. This migration is probably in re-

sponse to a desire to allow the embryos to escape. When the sought for situation has been reached the head is thrust through the skin, causing a small vesicle which is surrounded by a more or less inflamed area. The vesicle ultimately bursts, leaving an ulceration, at the base of which the head of the parasite may be demonstrated. Having discharged the embryos the parasite leaves the body. Usually there is but a single worm in one host, although this is not always the case.

Symptoms. These are those of a localized inflammation at the site of exit of the parasite; there may be a slight febrile movement but this is only transient if cleanliness is observed after removal of the parasite. If the worm is torn during its removal, suppuration with the usually associated symptoms is said to be a very probable result.

Treatment. Prevention consists in the thorough filtering and boiling of drinking water and in avoiding contact with muddy water in which the cyclops may be present.

The natives of the countries where the guinea-worm is common as a rule moisten the ulcerated bases of the ruptured vesicles and, when the head of the parasite is extruded, it is fastened round a bit of wood which is gradually twisted until after several days, the entire worm is withdrawn. Injection of mercury bichloride solution (1 to 1000) into the head will kill the parasite after which it may be readily pulled out. Injections of mercury into the tissue adjacent to the worm also kill it and it may be removed by excision. The wound should be dressed antiseptically; in this connection 1 to 15 phenol solution is recommended but should be carefully watched lest it cause gangrene of the part. The local application of the leaves of the "armapattee" plant is recommended by native physicians in India and large doses of asafœtida are said to be fatal to the parasite.

Other filariæ have been found in man but much less frequently than those previously described. Of these the following are worthy of brief mention.

Filaria loa occurs in West Africa and exists in the subcutaneous tissues, especially those of the face, where it wanders about causing burning and itching. It is particularly frequent beneath the conjunctiva where it induces swelling and inflammation. This parasite has been found in the Western Hemisphere whither it has probably been brought by African slaves.

Filaria immitis. This is a common parasite in the dog and has been found in the portal vein of man, the eggs being present in the walls of the ureters and bladder.

Filaria Bentis has been observed in a cataract. **Filaria trachealis and bronchialis** has been observed in the trachea, bronchi and lungs. **Filaria labialis** has been demonstrated in labial pustule and **Filaria hominis oris** has been found in the mouth.

TRYPANOSOMIASIS.

Trypanosoma hominis, the organism which is believed to be the cause of African sleeping-sickness, has been discussed in the section upon infectious diseases.

CESTODES.

ECHINOCOCCUS DISEASE.

Synonym. Hydatid Disease.

The **tænia echinococcus** has been described in the section upon diseases of the liver. Echinococcus diseases of the lungs, spleen and other organs have been discussed in the sections devoted to the affections of the organs in question and to these the reader is referred.

INTESTINAL CESTODES, TÆNIÆ OR TAPE-WORMS.

Various types of tæniæ are found in the human intestine as a result of the ingestion of the undeveloped larvæ which occur in the muscular tissue or other organs of animals. The ova of the tape-worm pass from the intestine of the host in the dejections and are taken into the bodies of various animals where they become fixed in the muscles or other tissues, probably being transferred thither by the blood or lymph currents. Within a few months after lodgment the ova develop into *cysticerci* or *bladder-worms;* these present the following characteristics. The cysticercus is inclosed in a thin connective tissue wall within which lies the bladder-worm, which really is the head of the future tape-worm and is termed the scolex. Behind the head there is a constricted neck consisting of undeveloped segments, the terminal one being distended into a bladder-like body. In some forms of tænia the ova may become encysted in the intestinal wall of the original host and subsequent development of the full-grown parasite in the intestine results in an auto-infection; more commonly, however, there is an intermediate host in the tissues of which the larvæ develop and are finally eaten by a third host to whose intestinal wall the parasite, its cyst wall being removed by the action of the digestive fluids, becomes attached and gives origin to segment after segment, thus forming a new tænia.

Tænia mediocanellata, *tænia saginata* or *beef tape-worm* is the most common variety of tape-worm in this country; it is also frequently found in other parts of the world, especially where beef is largely consumed. Its usual length is from 3 to 8 yards (3 to 8 meters); its head is four-sided and pear-shaped and possesses no hooklets or rostellum, but in place of

these is provided with four cup-shaped sucking-discs placed at its corners. The head is about $\frac{3}{32}$ of an inch (2 mm.) in diameter; the neck is slender and prolonged; the first segments are short, their transverse diameter exceeding their length. The segments gradually increase in length and near the posterior extremity of the parasite are about $\frac{2}{3}$ of an inch (16 to 18 mm.) long and about one-half as broad. The genital pores in adjacent segments irregularly alternate upon the opposite margins and are placed slightly posterior to the middle of the margin of each. The embryophores are slightly ovoid, brownish in color and measure 30 to 40 μ by 20 to 30 μ. The shell is thick and radially striated. The uterus is situated in the middle of each proglottis and consists of a median stem with eighteen to thirty lateral branches. The ripe segments are passed in the stools and are eaten by cattle, in the muscles of which the cysticerci develop. The cysticercus of tænia mediocanellata has never been found in human muscle.

Tænia solium (*the pork tape-worm*) is more common in Europe than in America and is taken into the human intestine with raw or insufficiently cooked "measly" pork. But one worm is usually present in a single host though multiple infections have been observed. Tænia solium is about 6 to 12 feet (2 to 4 meters) in length. Its head is more spherical than that of tænia mediocanellata and somewhat tetragonal in shape due to the presence of four cup-like thick-lipped suckers; the head is supplied with a thick rostellum bearing a double row of hooklets, about twenty-eight in number. The head is about the size of that of a pin; it is provided with a rather slender neck about $\frac{1}{3}$ of an inch (1 cm.) long and is succeeded by the segments or proglottides which, when mature, measure about $\frac{1}{3}$ of an inch (1.0 to 1.2 cm.) in length and about $\frac{1}{4}$ of an inch (6 to 8 mm.) in width. The segments are bisexual, the uterus being situated in the middle of each and appearing as a median stem with from seven to ten coarsely dendritic branches on either side. The male organs are small vesicular bodies placed in the anterior part of each proglottis. There are thousands of embryophores in each segment, the former being nearly spherical, light brown in color and measuring about 35 μ in diameter. The shell is thick and radially striated. The tænia solium reaches maturity and begins to give off ripe segments in about three to four months. The ova are taken into the intestinal tract of the hog or of man, and the embryos becoming freed from the shell by the action of the digestive juices, migrate to various parts, the muscles, brain, liver or eye, and become cysticerci.

Dibothriocephalus latus, *tænia lata* or *bothriocephalus latus* (*the fish tape-worm*) is found in the human intestine and in that of the dog and cat. This parasite does not occur in the United States except in imported instances but is common in Switzerland, Italy, Southern Germany, along the shores of the Baltic Sea and in Japan.

The larvæ develop in the peritonæal and muscular tissues of certain fresh-

water fish and are thus taken into the intestine of man. Dibothriocephalus latus is the longest of the tape-worms, the adult measuring from 10 to 30 feet (3 to 10 meters) in length; the head is elongated and almond-shaped, $\frac{3}{32}$ to $\frac{3}{16}$ inch (2 to 5 mm.) long and about $\frac{1}{32}$ of an inch (0.7 mm.) broad; it is supplied with two lateral groove-like suckers; there are no hooklets. The length of the neck varies according to the degree of contraction. The segments number from 3,000 to 4,000, the anterior links being not well marked; they increase slightly in length but markedly in width, the mature segments being $\frac{3}{32}$ to $\frac{5}{32}$ of an inch (2 to 4 mm.) long and $\frac{1}{3}$ to $\frac{2}{3}$ of an inch (1 to 2 cm.) wide. The ova are ellipsoidal, 68 to 70 μ by 45 μ, and operculated. Ovulation takes place in the intestine and the eggs are discharged from the uterus, appearing in the dejections in large numbers. Further development takes place in water and the embryo is presumably swallowed by its intermediate host.

Dibothriocephalus cordatus is similar to the above and is commonly a parasite of seals. It has been observed in man in one instance.

Bothriocephalus Mansoni has been observed in the larval stage only; this has been found in the subcutaneous tissue, in the pleural cavity and in the urine. The larva is thick, flat and about an inch (3 cm.) in length.

Dipylidium caninum, *tænia canina*, *tænia eliptica* or *tænia cucumerina* is common in the dog and has been found in the human intestine, more especially in children. The intermediate hosts are the dog flea (*pulex serraticeps*), dog louse (*trichodectes canis*) and the human flea (*pulex irritans*). These insects get the ova from fæcal matter adherent to the hairs about the anus of the dog and the larvæ are transferred to the human alimentary tract upon the fingers, these having been used to crush fleas, or having been licked by dogs. The parasite is 6 to 14 inches (15 to 35 cm.) long; its ova are spherical and from 43 to 50 μ in diameter.

Hymenolopsis nana (*tænia nana*) is most frequently observed in Italy and other parts of southern Europe. It is common among the children of the poorer classes; the parasite inhabits the lower portion of the ileum and as many as a thousand may be present in a single individual. Tænia nana is common in the rat and is conveyed to the human intestine upon water contaminated with the fæcal matter of these animals or that of a human host, upon food to which rats have had access or upon fingers which have been soiled by contact with the anal tissues. The worm is from $\frac{1}{3}$ to $\frac{1}{2}$ an inch (1 to 1.5 cm.) or more in length; the subglobular head is supplied with four suckers and a rostellum surrounded by a single row of hooklets. The neck is slender and is succeeded by about 150 short, broad segments. The ova are oval or spherical, about 40 μ in diameter and possess a double wall.

Hymenolopsis diminuta or *tænia flavopuncta* occurs as a parasite of

rats and mice and has been observed in man. The larvæ develop in beetles, earwigs and especially in meal moths in the larval stage. The worm is from $\frac{1}{3}$ of an inch to 2 inches (10 to 60 mm.) long and possesses a small globular head with four suckers and a rostellum without hooklets; the neck is short and is succeeded by 800 to 1,200 or more segments which are short and broad. The ova are rounded, yellowish and double-walled, the external diameter being from 54 to 86 μ.

Hymenolopsis lanceolata or *tænia lanceolata* is found as a parasite of geese and ducks in Europe and has occurred in the human subject in at least one instance. The adult worm measures from 1 to 5 inches (3 to 13 cm.) in length; the head is very small and is supplied with a rostellum which possesses eight hooklets and four suckers. The neck is short and is followed by about 300 short broad segments. The ova are double-walled, spherical and from 60 to 100 μ in diameter. The larvæ of this parasite are believed to exist in certain crustaceans.

Davainea Madagascariensis or *tænia Madagascariensis* has been found as a human parasite in Madagascar, Guiana, Mauritius and Eastern Asia. The larval form has not been observed. The adult worm is about an inch (3 cm.) long; the head is small with four suckers and a retractile rostellum fitted with a double row of about 90 hooklets. The segments number from 500 to 700 and are slightly longer than broad. The embryo is from 8 to 15 μ long and is surrounded by a thin double wall.

Tænia confusa is a recently described species about which little is known but which may be a variety of tænia solium. The parasite has been observed in one instance in Nebraska.

Tænia Africana and **tænia marginata** are rarely observed in the human subject.

Tape-worms are found in patients of all ages, even young children may be affected.

Symptoms. These are not definite nor diagnostic in any way, the existence of the parasite frequently being evidenced by no suspicious manifestations whatever. In other instances various symptoms of local irritation may be present and neurotic individuals, when aware of their disease, often complain of symptoms which have a purely imaginary basis. Local manifestations such as abdominal distress, sensations of weight and fulness in the region of the stomach, particularly after eating, capricious appetite, diarrhœa alternating with constipation, salivation, nausea and vomiting and emaciation with anæmia are sometimes observed.

Reflex nervous phenomena are not unusual and may consist of irritability of temper, mental depression, lassitude, insomnia, vertigo, itching at the nose, ringing in the ears, visual disturbances and pupillary dilatation. Choreic movements and epileptiform convulsions are said to occur in rare instances

but their causation can generally be explained upon other basis than that of the presence of tæniæ.

Marked and even fatal anæmia has been brought about by the presence of the *dibothriocephalus latus* and may be due to some toxic substance produced by the worm.

The diagnosis can be certainly made only by finding segments of the parasite or its eggs in the fæces or upon the underclothing and if tape-worm is suspected the administration of some simple purge will unless the suspicion is groundless, bring to light conclusive proof.

The prognosis of tape-worm disease is uniformly favorable.

Treatment. *Prophylaxis* consists in using none but thoroughly cooked meat or fish for food, in boiling all drinking water, in destroying, by cremation, all fæcal matter which may contain segments or ova, for if these are not so disposed of there is likelihood that they may be ingested by hogs or cattle. The institution of governmental inspection of the carcasses of animals used for food is most important in the prevention of tape-worm disease, although cold storage is said to destroy the cysticerci in three or four weeks. It is an interesting fact that the larvæ are found chiefly in the muscles of the jaw in the case of the beef tape-worm.

There are various effectual methods of ridding the intestine of tape-worms and numerous drugs have been employed with this object in view. The following formula will be found most certain. ℞ corticis granati, ℥ss (15.0); seminis peponis, ℥iii (90.0); ergotæ, ℥ss (2.0); contere et boulliat semi hora in aqua, ℥viii (250.0); cola et adde extractum filicis ætheris, ℥i (4.0); oleum tiglii, ♏ ii (0.13); pulverem acaciæ, ℥ii (8.0). Misce et fiat emulsio. Signa—Take six teaspoonsful (24.0) of Rochelle salt on retiring and the remedy in the morning.

Many clinicians advise the patient to subsist upon a light diet, consisting of bread, milk and soups, for two or three days preceding the administration of the anthelmintic in order that the parasite may be somewhat weakened and its hold upon the intestinal mucosa rendered less firm; the systematic administration of mild purges for a day or two before taking the tæniafuge is also advised in order that the bowel may be cleared of fæcal matter which might otherwise in some degree protect the worm. In this connection it should be stated that castor oil should not be given in connection with any preparation of male fern for the former markedly increases the solution and absorption of filicic acid which sometimes causes toxic symptoms.

Kousso flowers are an active anthelmintic but must be fresh in order to exert their best effect and have the disadvantage that they are likely to cause emesis and intestinal distress. An infusion of 1 ounce (30.0) of the flowers in 8 ounces (250.0) of water, taken in the morning and preceded the night before by a saline cathartic, will usually cause the death of the parasite. A

purge is seldom necessary after the administration of kousso but should the parasite not appear within six hours after it has been taken, a cathartic is indicated. Koussin, a resin obtained from kousso has been given with good results, the dose being 20 to 40 grains (1.33 to 2.66) in capsules.

Pomegranate may be given alone as a tæniafuge as well as in the combination suggested above. It is best administered in decoction (B. P., 1 to 5, dose ½ to 2 ounces—15.0 to 60.0) and of this several doses may be taken, fasting at hour intervals. It should be preceded by a brisk cathartic and, if the remedy does not have a purgative effect, followed by another. In case the patient is unable to take the decoction on account of its exceeding unpalatable taste it is recommended that the proper quantity should be evaporated upon a water bath to a pilular consistency and administered in capsules.

Pelletierine tannate, a mixture of the active principles of pomegranate, is one of the most reliable tæniafuges and is decidedly preferable to pomegranate itself on account of the facility with which it can be taken and its freedom from nauseating properties. It is usually given in capsules, preceded and followed by a purge. It should be administered with great caution to children. The dose for an adult is 4 gr. (0.250).

Pumpkin seed is considered less efficient than the previously mentioned anthelmintics; it is preferably given in emulsion which is prepared by powdering 2 ounces (60.0) of the seeds in a mortar with 8 ounces (250.0) of water until the husks are loosened and an emulsion is made, the mixture is then strained and the whole amount taken fasting; some observers consider that the effect is better if the husks are not strained off. The seeds may also be beaten into a paste with milk and sugar. The resin in doses of 15 grains (1.0) and the expressed oil in doses of 4 drachms (15.0) have been used as substitutes for the seeds and are said to be equally efficient.

Kamala in doses of 1 to 2 drachms (4.0 to 8.0) will kill the *tænia solium* and may be given mixed with syrup to which a little hyoscyamus is added to prevent griping; the dead parasite will often appear at the third or fourth stool after the use of the drug. If a single dose is ineffective it may be repeated at three hour intervals until five or six doses have been taken.

To be certain that the entire worm has been expelled by any given mode of treatment it is necessary to find the head of the parasite and this often entails a careful search, for, being very small, this part is easily lost in the discharges. Even though the head is not found, in many instances it may have been passed and overlooked. If it remains in the intestine in three to four months segments will again appear in the stools and treatment may be repeated. Obstinate instances may be due to the fact that the head is hidden beneath the valvulæ conniventes and is thus protected from the action of the tæniafuge.

PARASITIC INSECTS.

ARACHNIDÆ AND TICKS.

Sarcoptes or **acarus scabiei** or the *itch mite* is not uncommon in persons of uncleanly habits. It is nearly circular in shape and hardly visible to the naked eye. The female burrows in the epidermis more especially where the skin is thin as between the fingers, upon the flexor surfaces of the knees, in the groins, etc. The eggs are deposited in this burrow and hatch in about one week and reach the adult stage about fourteen days later. The parasite is most frequently observed in persons of uncleanly habits and is transferred by bodily contact or upon clothing.

Symptoms. These consist of intense pruritus; the burrows may be detected in the skin of the affected parts but are often obscured by scratch marks.

Treatment. The body should be thoroughly cleansed with soft soap and hot water for the purpose of breaking open the burrows and exposing the parasite; next the surface should be rinsed with cold water and dried, after which sulphur ointment should be rubbed carefully into the skin. The official ointment in full strength is often too irritating and it is usually wise to dilute it somewhat. The following application may also be employed: Oil of cade, 1 drachm (4.0); sulphur ointment, 2 drachms (8.0); lanolin, 5 drachms (20.0). After the inunction the patient should go to bed and the next morning should wash himself clean and put on clean clothing. One such application is usually sufficient to effect a cure but it may be repeated once or twice. In order to prevent re-infection the bed linen and the clothing previously worn should be burned or disinfected by boiling or exposure to steam under pressure.

Sarcoptes scabiei hominis is a variety of the itch mite which infests the cat, dog, cow, horse, and other animals; it is sometimes transferred to man but dies spontaneously.

Leptus autumnalis (*the harvest bug*) is a tiny red parasite possessing six legs, rows of bristles upon its dorsal and ventral surfaces and sharp mandibles. It is common in summer on grass and other plants and attaches itself particularly to the skin of the ankles and legs into which it penetrates sufficiently far to obtain nourishment. It causes irritation and pruritus.

Treatment consists in inunctions of sulphur, mercury or naphthol ointments or the employment of a lotion of 1 to 500 mercury bichloride solution.

Demodex folliculorum (*the comedo mite*) is a minute parasite with a worm-like body and short legs. It is about $\frac{1}{60}$ of an inch (0.3 to 0.4 mm.) in length and infests the sebaceous follicles of the skin, particularly that of the face and nose, from which it can often be expressed. It causes no special symptoms but may incite inflammation of the follicles.

Treatment. The insect may be expressed by means of a watch key or a comedone extractor. Prevention consists in frequently washing the face with a pure soap and a flesh brush; 1 to 500 mercury bichloride solution may be employed as a lotion.

Pentastomata. These include the *pentastomum tænioides* (lingulata rhinaria) which inhabits the nasal fossæ of the dog, horse and rarely, those of man. The female possesses a lancet-shaped body from 3 to 4 inches (9 to 12 cm.) long while the male is about a third of this size. The ova are ejected in sneezing and may be taken into the human body. The larvæ have been found in the liver, lungs, and kidneys.

Pentastomum constrictum (*porocephalus constrictus*) is a very rare parasite about ½ an inch (1.5 cm.) long which has been found in a few instances in the liver and lungs. In one case the parasites were expectorated in considerable number.

Ixodiasis (tick fever) has been considered in the section upon infectious diseases.

PARASITIC FLIES.

Myiasis. This term is applied to the condition characterized by the presence of the larvæ of various species of flies (diptera). Several varieties of flies, notably the flesh or blue-bottle fly (*sarcophila carnaria*), the common house fly (*musca domestica*), the blow-fly (*calliphoria vomitoria*) and the screw-worm fly (*compsomyia macellaria*) deposit their eggs upon wound surfaces, these hatch within twenty-four hours and the lesions become filled with maggots or larvæ, producing the condition known as *myiasis vulnerum*.

The ova of the above mentioned flies may also be taken into the alimentary tract and cause *intestinal myiasis;* the larvæ of these and of other species have been observed in vomitus and fæces. Usually intestinal myiasis is not attended by any serious results, sometimes ulcerations and fatal inflammations of the colon result.

Ova are sometimes deposited in the nostrils, ears, conjunctivæ, urethra and vagina but, as a rule, not unless disease is present in these situations. Serious consequences may follow the presence of larvæ in the ears and nose.

Cutaneous myiasis is usually due to the larvæ of bot-flies (estridæ). These attack the skin of the horse, ox, sheep, and other animals and have been observed in man, in most instances in tropical regions. The parasites bore beneath the skin and cause lesions resembling boils; the parts most frequently attacked are the abdomen and scrotum.

Myiasis of the skin, due to the presence of the larvæ of *musca vomitoria* has been noted.

In Russia, and more rarely elsewhere, cutaneous infection with the larva

of the horse bot-fly (*gastrophilus equi*) produces a migrating eruption consisting of a slightly raised pinkish line which traverses the skin with more or less rapidity.

An epidemic urticaria is common in certain countries as a result of the presence of different species of caterpillars especially the *cnethocampa*. Actual contact with these insects is said not to be necessary for the production of this eruption.

OTHER PARASITIC INSECTS.

PEDICULOSIS.

Synonym. Phthiriasis.

Three forms of pediculi are parasitic in man, the *pediculus capitis, the pediculus corporis and the pediculus pubis.*

Pediculus capitis (*the head louse*) infests the hair and scalp of uncleanly individuals. The male insect is about $\frac{1}{2}\frac{1}{5}$ of an inch (1 mm.) in length while the female is somewhat longer. The parasites multiply with great rapidity, the female laying 50 or more ova or nits. These are attached to the hairs, are hatched in about a week and within three weeks are able to reproduce themselves.

Symptoms. These consist of itching and irritation of the scalp and if the insect bores beneath the skin, an eczema or pustulous dermatitis may be excited, particularly in the occipital region, which results in the production of crusts and scabs which mat the hair into a filthy and disgusting mass known as the *plica polonica* from its frequence amongst the Polish Jews.

The diagnosis is easily made by observing the insect itself or by detecting the nits, which are minute whitish bodies attached to the hairs.

Treatment. To rid the scalp of the adult parasites is an easy matter but to destroy the ova is quite a different consideration. The lice themselves may be killed by thoroughly rubbing kerosene or turpentine into the hair. Staphisagria is a classical and effective parasiticide and a combination of the fluidextract with acetic acid and æther (1 to 8) is recommended; the acid will dissolve the gum with which the nits are stuck to the hairs and permit their removal with a fine toothed comb. Such removal is usually necessary, especially in women who object to clipping of the hair. Staphisagria should not be applied if the scalp is abraded for poisonous symptoms have been observed to follow its use. Phenol in 2 percent. solution and the tincture of cocculus indicus may also be employed. In using any of the remedies suggested it is wise to make the applications upon several successive evenings, the patient sleeping with the moistened hair wrapped in a turban made of a towel and taking a thorough shampoo on rising.

Pediculus corporis or **vestimentorum** (*the body louse*) inhabits the seams

in the clothing of persons of filthy habits and derives its sustenance by sucking the blood through its proboscis which it inserts through the skin. These punctures are often evidenced by a minute hæmorrhagic point and are most abundant upon the neck, back and abdomen. The parasite is twice or three times the size of the head louse and is whitish-gray in color. It deposits its eggs upon the underclothing, where they may be found after a prolonged search.

Symptoms. These, as in the case of the head louse, consist of pruritus and irritation. Linear scratch marks may be observed and in long-standing instances a scaly and pigmented condition of the skin (*vagabond's disease*) results.

Treatment. The infected clothing should be burned or subjected to steam or hot-air disinfection. The itching may be relieved by warm baths to which sodium carbonate or bicarbonate has been added and by the application of antipruritic lotions.

Pediculus pubis or **inguinalis** (*the crab louse*) is about $\frac{1}{25}$ of an inch (1 mm.) in length, yellowish-gray in color and possesses six legs with strong claws. The parasite infests the hairy parts of the body such as the pubic region, the chest and axillæ; it may also reach the beard and eyebrows. Like the preceding parasites it causes itching and irritation.

Treatment consists in the application of mercurial ointment or the ointment of ammoniated mercury. Beta naphthol, 15 grains (1.0) to the ounce (30.0) of vaseline is also effective. Shaving the hair may be necessary.

Cimex lectularius (*the bed bug*) is a flat brown insect from $\frac{1}{12}$ to $\frac{1}{5}$ of an inch (2 to 5 mm.) in length and slightly less in breadth. It infests beds and the cushions of public vehicles and possesses a characteristic and unpleasant odor. It subsists upon the blood which it sucks, and causes, in most persons, a troublesome itching and irritation of the skin. Certain individuals appear to be indifferent to or immune from its attacks. The female lays about 50 ova several times a year in the crevices of furniture and walls.

Treatment. The irritation of the bite of *cimex lectularius* may be relieved by antipruritic lotions. To rid furniture and apartments of the pest fumigation with sulphur, and painting of crevices in walls, floors and elsewhere with 1 to 500 mercury bichloride solution, kerosene, or a mixture of oil of cedar 1 part, spirit of turpentine or methyl alcohol 8 parts, are suggested.

Pulex Irritans (*the common flea*) is found almost universally. The male is about $\frac{1}{12}$ of an inch (2 mm.) in length while the female is twice this size; in color the insect is nearly black or, when filled with blood, brownish.

It does not infest man naturally but may do so in districts where it is very abundant. The bite is very irritating to susceptible subjects, being evidenced by a slightly raised, circular red spot in the center of which the insect's proboscis has entered; other individuals may suffer no inconvenience.

Treatment. The irritation may be relieved by soothing applications. Where the insect is a common pest, rubbing the skin with one of the essential oils such as that of pennyroyal (*hedeoma*) may prevent its onslaughts.

Pulex penetrans (*the sand-flea, jigger* or *chigœ*) is common in tropical countries and in the Southern United States. It is considerably smaller than the common flea and is brownish in color.

The parasite bites all warm-blooded animals, including man, just as does the common flea. Impregnated females burrow into the tissues, particularly those of the feet, where they mature their eggs, the abdomen enlarging during this process to the size of a small pea. The mature ova are laid while the female is imbedded in the flesh of the host and escape thence into the dust of the ground or floor where they hatch into larvæ. The shell of the parent when dead and empty of eggs usually causes no further trouble although at times irritation, abscesses and ulcers have been observed to result. If the parasite is removed from the host she extrudes her eggs and perishes and the eggs so laid do not hatch into larvæ.

The chigœ does not often produce serious lesions but infection, gangrene and even death may result indirectly from its presence.

Prevention of the entry of the parasite may be accomplished by wearing high shoes and closely woven stockings.

The insects may be prevented from entering dwellings by sprinkling the floors with kerosene or naphthol.

Treatment consists in the removal of the parasite by means of a dull knife or needle, strict asepsis being observed. The removal is also an important point in prophylaxis for the eggs are continually being dropped from the host who thus becomes dangerous to his associates. If infection of the lesion has taken place it should be treated by the usual surgical and antiseptic methods.

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Treatment of Disease

10-20-32		Included in 10-21-36